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6. AUTHOR(S)
J. Anderson, T.J. Sereno, Jr., H. Swanger, J. Given, D. Williams

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Science Applications International Corporation (SAIC)
10210 Campus Point Drive
San Diego, CA 92121

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This technical report updates SAIC-91/1138, published February 1991. It describes the IMS extensions to the Center Version 3.0 database schema, documented in Technical Report C90-01 (Sept. 1990). This report briefly describes IMS pipeline processing and the application-specific tables designed to support this processing.

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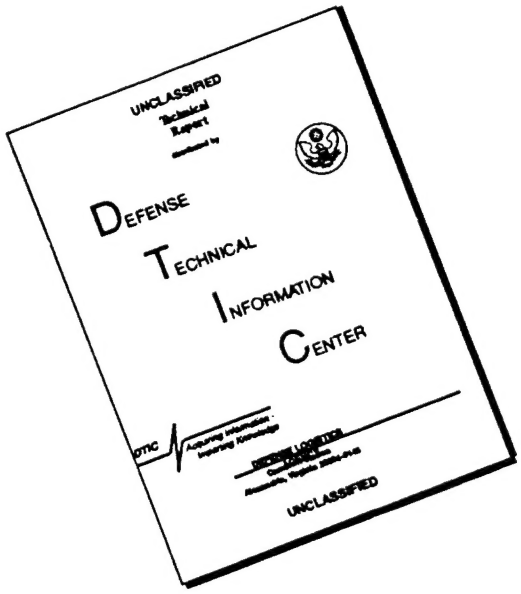

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II. IMS Pipeline Processing

A relational database supports the IMS processing by providing:

- centralized data storage
- support for distributed processing
- concurrency control and crash recovery
- a scratch pad for temporary results, and
- a place for processes to log progress

Figure 1 shows a database-centric view of the IMS Pipeline processing. The following sections describe each of these processing steps and their interaction with the ORACLE database. The emphasis is on the relationship between the IMS processing pipeline and the IMS extension database tables. We do not explicitly identify the role of Version 3 core tables in these sections; this is described by Bache *et al.* 1991.

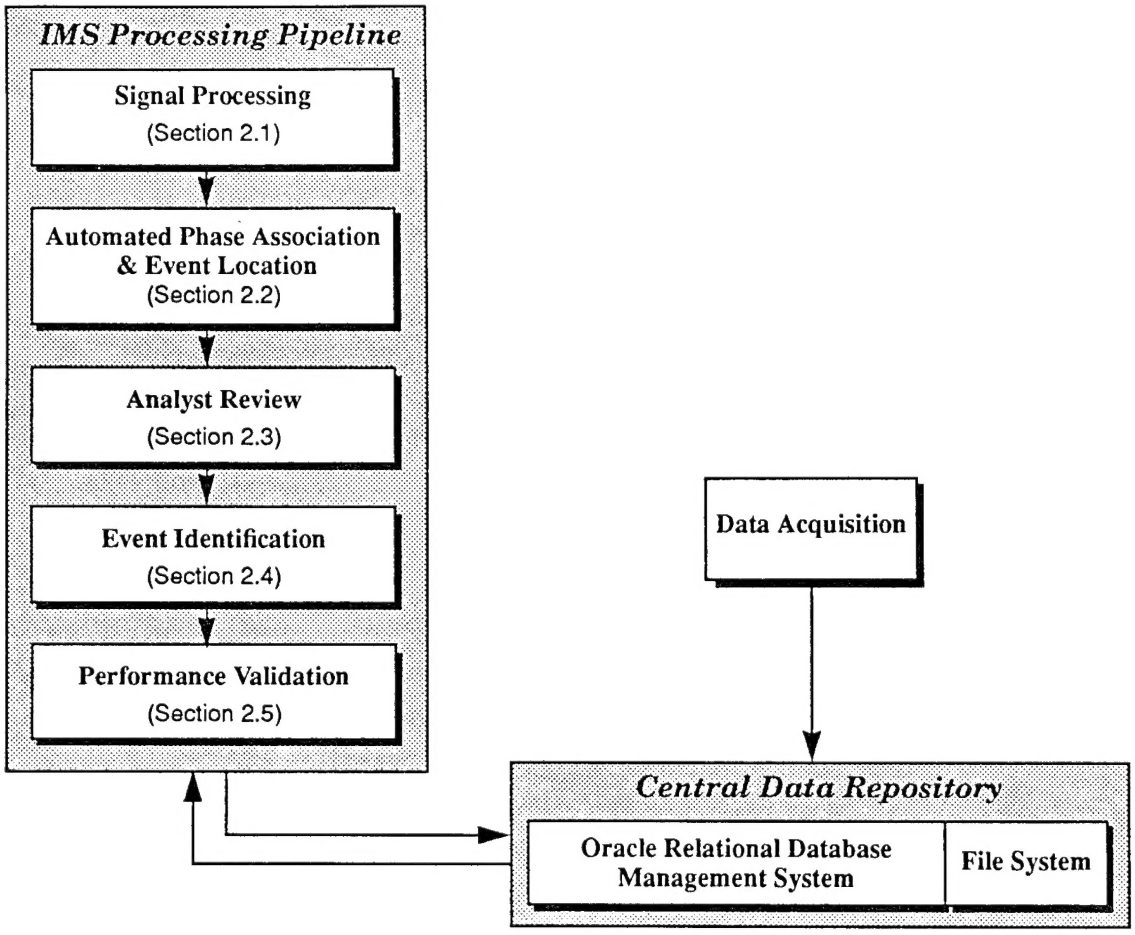
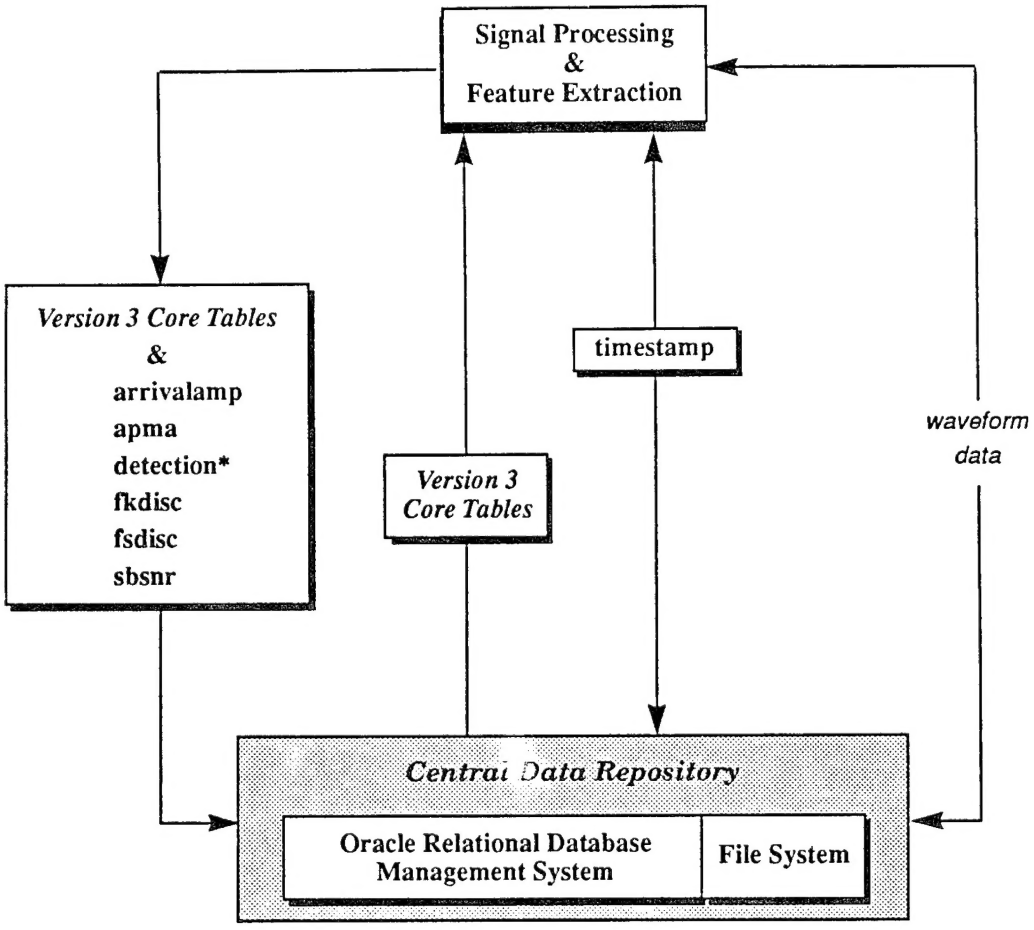


Figure 1. IMS Processing Pipeline *(data acquisition is external to IMS).*

2.1 Signal Processing

Figure 2 depicts the signal processing portion of the IMS Pipeline. The Signal Processor (SigPro) checks the **timestamp** table to see if there are new data to process for a given station, and reads the **wfdisc** table to locate waveform data (**wfdisc** is a Version 3 core table). SigPro then processes the raw data and writes the results to **detection**, **apma**, and **sbsnr**. SigPro can also write to **fkdisc** and **fsdisc** if frequency wave number (*f-k*) files or Fourier spectra are written to disk. A separate process calculates frequency-dependent amplitudes and writes them to **arrivalamp**. As IMS extensions evolve, results previously written to **detection** will be written to **arrival** and **arrivalaux**. SigPro updates the **timestamp** table to indicate which data have been processed.



*The detection table will be replaced by arrivalaux.

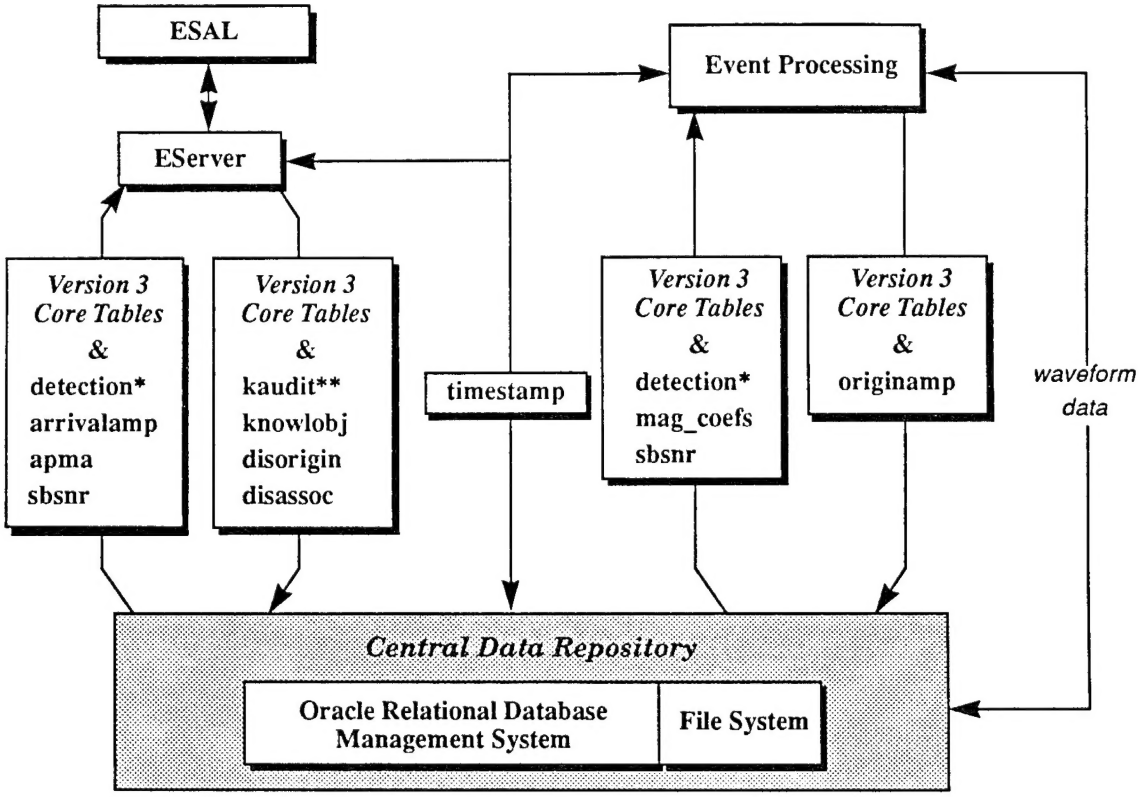
Figure 2. IMS Pipeline: Signal Processing.

2.2 Automated Phase Association and Event Location

Figure 3 depicts the phase association and event location portion of the IMS Pipeline. ESAL [Bratt *et al.* 1991] is the key component, although it does not interact directly with the database.

EServer is the interface between the database and ESAL. It checks the **timestamp** table to see if there are data to process. If so, it extracts features from the database and writes them to flat files for input to ESAL. After ESAL has completed its processing, EServer writes the results back to the database.

Several event-processing programs are executed once an event hypothesis has been created by ESAL. These include programs to form event beams, calculate magnitudes and origin-based amplitude measures, and others. These programs are coordinated through the Process Manager [Given *et al.* 1993].



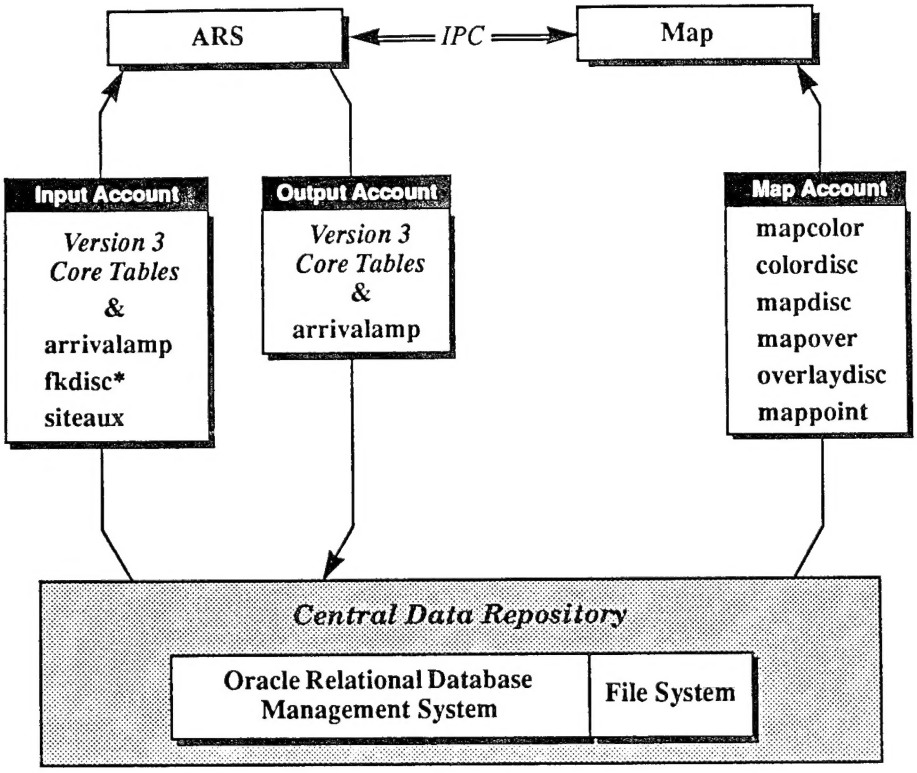
*The detection table will be replaced by arrivalaux.
**EServer will eventually write to three other tables for the audit trail (koconst, kovar, koparamdesc), but these tables are not yet implemented.

Figure 3. IMS Pipeline: Automated Phase Association and Event Location.

2.3 Analyst Review

Figure 4 depicts the analyst review of ESAL results. The analyst uses the Analyst Review Station (ARS) to correct the origin hypotheses as needed, and plots the new locations with the IMS Map program. ARS is described by Wang *et al.* 1991. The Map program is currently being developed. Data are passed between ARS and the Map program by Interprocess Communications (IPC).

To preserve source data for audit trail analysis, ESAL results are not directly updated. Instead, data are read from one input account and results are written to another output account. The Map program reads semi-static lookup data from a centralized account, listed as the Map Account in Figure 4.

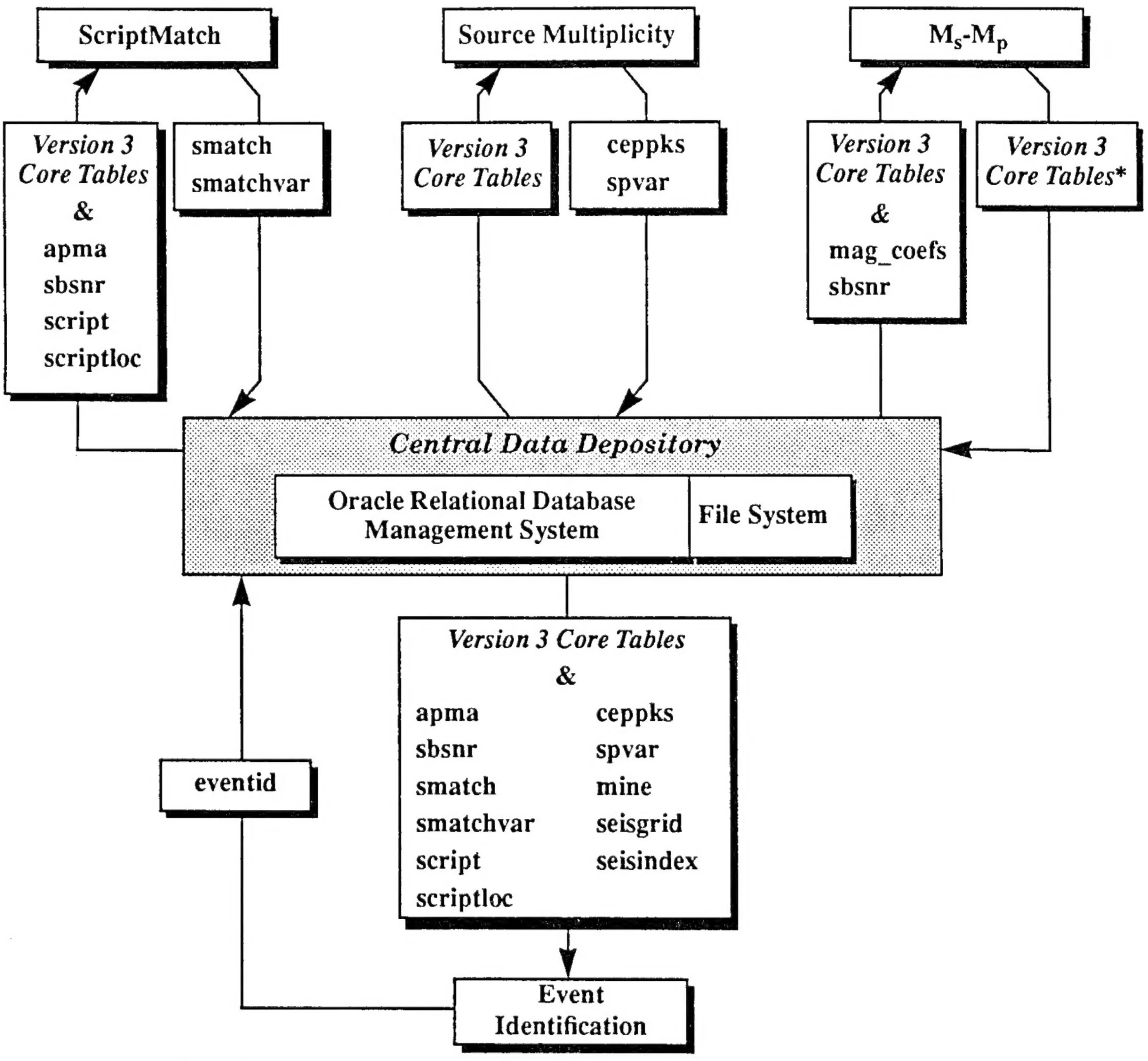


*actually used by an f-k display program that is called by ARS via IPC

Figure 4. IMS Pipeline: Analyst Review.

2.4 Event Identification

Figure 5 depicts event identification processing. ScriptMatch is a case-based approach that determines how well an event fits a script for a particular source region (e.g., a mine site). Source Multiplicity looks for peaks in the cepstrum as evidence for ripple-firing which is a technique commonly used in industrial mining. M_s-M_p computes the difference between regional P-wave and S-wave magnitudes. Event Identification uses fuzzy-logic to combine evidence from multiple discriminants that are based on the seismic signals with contextual discriminants (location, magnitude, seismicity and depth) to derive a composite event identification such as earthquake, explosion, or mine blast.



*Three amplitude tables (ampdescript, arrivalamp, originamp) are planned but not yet implemented into the Event Identification System.

Figure 5. IMS Pipeline: Event Identification. *We plan to add the waveform correlation method developed by Riviere and Grant (1992), and this will require three other tables: refarea, refout, refevent.*

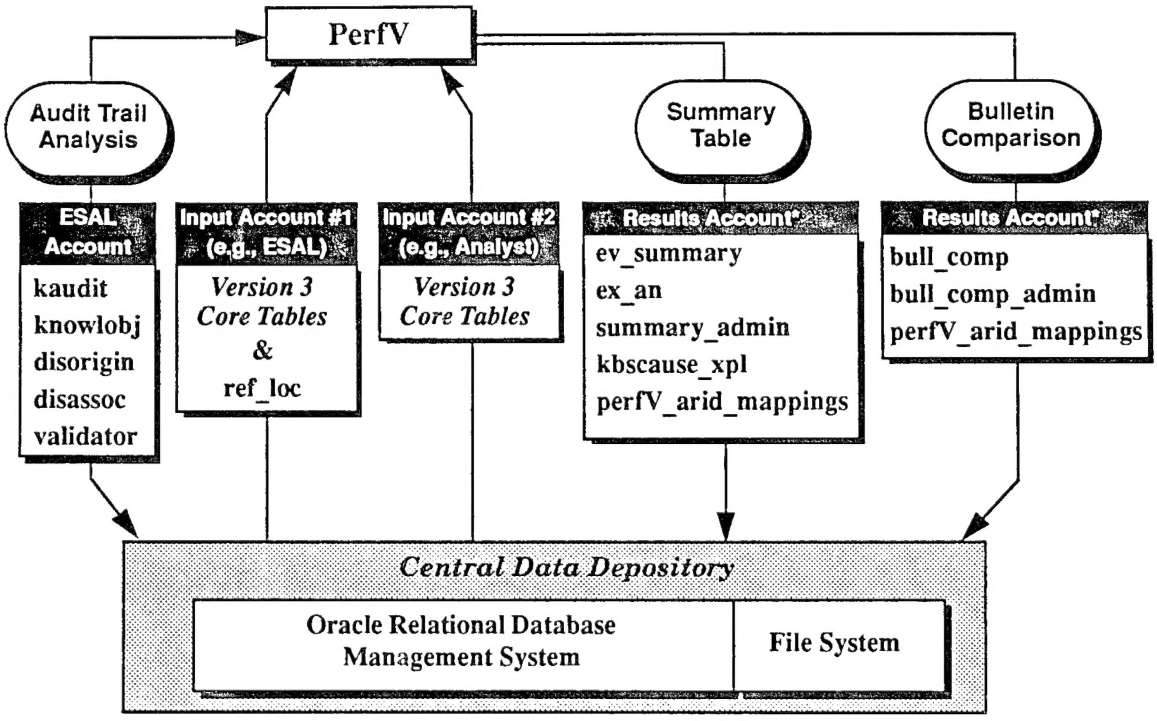
2.5 Performance Validation

Figure 6 depicts PerfV analysis of ESAL results performed in several sub-tasks:

- **Audit Trail Analysis:**
  This module compares the analyst and ESAL results and marks the audit trail as "valid", "invalid" or "ignored". This is used to identify areas in the knowledge base that need improvement, and to characterize ESAL's performance in broad classes (e.g., station-association, station-phase identification, network-phase identification).

- **Summary Table Generation:**
  This module compares an ESAL bulletin to an analyst bulletin. ESAL and analyst solutions are characterized and stored in separate tables, each with the structure of **ev_summary**. Differences between ESAL and analyst solutions are stored in **ex_an**.

- **Bulletin Comparison:**
  This module compares any two seismic bulletins. The results are written in the **bull_comp** table.



*Four other tables for the audit trail (koconst, kovar, koparamdesc, audit_admin) are planned but not yet implemented.

Figure 6. IMS Pipeline: Performance Validation.

III. IMS Database Structure

This section defines the physical structure of each application table as it exists within the Oracle data dictionary and as it can exist as a flat file. The name of each relation is displayed in **bold** print at the top of each table, with a brief description. Attributes of each relation are displayed in *italics* along with a field number, storage type, external format, character position and description. Formats for "external" files specify fixed-field widths and precisions in the style of Fortran. Exactly one blank separates fields in these files. This improves readability and makes it easier for C programs to scan the records.

Relation:	ampdescript				
Description:	Parameters used to make origin-based or arrival-based amplitude measures				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
amptype	1	c8	a8	1-8	amplitude measure descriptor
toff	2	f4	f6.2	10-15	offset from theoretical or observed arrival time
tlen	3	f4	f6.2	17-22	duration of measurement window
gvlo	4	f4	f5.2	24-28	low group velocity for measurement window (km/sec)
gvhi	5	f4	f5.2	30-34	high group velocity for measurement window (km/sec)
mtype	6	c8	a8	36-43	measurement type
descr	7	c255	a255	45-299	description
lddate	8	date	a17	301-317	load date

Relation:	apma				
Description:	Results of particle motion analysis				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
phase	1	c8	a8	1-8	phase
arid	2	i4	i8	10-17	arrival identifier
freq	3	f4	f7.2	19-25	frequency
snr	4	f4	f10.2	27-36	signal-to-noise ratio
ampp	5	f4	f7.2	38-44	P-phase amplitude
amps	6	f4	f7.2	46-52	S-phase amplitude
amplr	7	f4	f7.2	54-60	Rayleigh-phase amplitude
rect	8	f4	f7.3	62-68	rectilinearity
plans	9	f4	f7.2	70-76	s-phase planarity
planlr	10	f4	f7.2	78-84	Rayleigh-phase planarity
hvratp	11	f4	f7.2	86-92	P-phase horizontal-to-vertical ratio
hvrat	12	f4	f7.2	94-100	S-phase horizontal-to-vertical ratio
hmxmn	13	f4	f7.2	102-108	maximum-to-minimum horizontal ratio
inang3	14	f4	f7.2	110-116	short-axis incidence angle
seazp	15	f4	f7.2	118-124	P-phase observed azimuth
seazs	16	f4	f7.2	126-132	S-phase observed azimuth
seazlr	17	f4	f7.2	134-140	Rayleigh-phase observed azimuth
inang1	18	f4	f7.2	142-148	long-axis incidence angle
ptime	19	f8	f17.5	150-166	P-phase extraction time
stime	20	f8	f17.5	168-184	S-phase extraction time
auth	21	c15	a15	186-200	author
apmarid	22	i4	i8	202-209	apma recipe identifier
commid	23	i4	i8	211-218	comment identifier
lddate	24	date	a17	220-236	load date

Relation:	**arrivalamp**				
Description:	Stores amplitude measurements for arrival records				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
arid	1	i4	i8	1-8	arrival identifier
chan	2	c8	a8	10-17	channel descriptor
amp	3	f4	f11.2	19-29	amplitude
per	4	f4	f7.2	31-37	period at time of amplitude measure
delamp	5	f4	f11.2	39-49	amplitude uncertainty
amptime	6	f8	f17.5	51-67	time of amplitude measure
amptype	7	c8	a8	69-77	amplitude measure descriptor
inarrival	8	i2	i4	79-82	flag to indicate if *amp* is the same as it is in the Version 3 arrival table
lddate	9	date	a17	84-100	load date

Relation:	**audit_admin**				
Description:	Audit trail administration table				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
expert	1	c50	a50	1-50	name of Expert (KBS) account
analyst	2	c50	a50	52-101	name of analyst account
begin_time	3	c30	a30	103-132	begin time
end_time	4	c30	a30	134-163	end time
lddate	5	date	a17	165-181	load date

Relation:	bull_comp				
Description:	Results of a comparison of two seismic bulletins				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
orid1	1	i4	i8	1-8	origin identifier from bulletin 1
orid2	2	i4	i8	10-17	origin identifier from bulletin 2
ddist	3	f4	f8.3	19-26	difference in distance
ddepth	4	f4	f6.1	28-33	difference in depth
dtime	5	f4	f8.3	35-42	difference in epoch time
ndef1	6	i4	i8	44-51	number of time-defining phases for *orid1*
ndef2	7	i4	i8	53-60	number of time-defining phases for *orid2*
dndef	8	i4	i8	62-69	difference in number of time-defining phases
narr1	9	i4	i8	71-78	number of associated arrivals for *orid1*
narr2	10	i4	i8	80-87	number of associated arrivals for *orid2*
dnarr	11	i4	i8	89-96	difference in number of associated arrivals
nmatch	12	i4	i8	98-105	number of matching arrivals (defining/non-defining)
ndef1arr2	13	i4	i8	107-114	number of defining arrivals for *orid1* that are arrivals (defining/ non-defining) for *orid2*
ndef2arr1	14	i4	i8	116-123	number of defining arrivals for *orid2* that are arrivals (defining/non-defining) for *orid1*
asstr	15	c1	a1	125-125	association strength (s or w)
lddate	16	c30	a30	127-156	load date

Relation:	bull_comp_admin				
Description:	Administrative information about the comparison of two bulletins				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
expert1	1	c50	a50	1-50	*expert1* database account
expert2	2	c50	a50	52-101	*expert2* database account
begin_time	3	c30	a30	103-132	begin time
end_time	4	c30	a30	134-163	end time
norid1	5	i4	i8	165-172	number of *expert1* orids
norid2	6	i4	i8	174-181	number of *expert2* orids
nmorid	7	i4	i8	183-190	number of strongly-associated matching orids
nmoridw	8	i4	i8	192-199	number of weakly-associated matching orids
lddate	9	date	a17	201-217	load date

Relation:	**ceppks**				
Description:	Results of cepstral analysis				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
orid	1	i4	i8	1-8	origin identifier
sta	2	c6	a6	10-15	station code
ptyp	3	c6	a6	17-22	consistent peak type code
pkamp	4	f4	f7.2	24-30	consistent peak amplitude
pkqf	5	f4	f7.2	32-38	consistent peak quefrency
lddate	6	date	a17	40-56	load date

Relation:	**colordisc**				
Description:	Colormap disk file				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
colormapid	1	i4	i8	1-8	colormap identifier
dfile	2	c32	a32	10-41	data file name
dir	3	c64	a64	43-106	directory
colormapname	4	c64	a64	108-171	colormap name
lddate	5	date	a17	173-189	load date

Relation:	**detection**				
Description:	Attributes describing a detected seismic signal				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
arid	1	i4	i8	1-8	arrival identifier
jdate	2	i4	i8	10-17	julian date
time	3	f8	f17.5	19-35	epoch time
sta	4	c6	a6	37-42	station code
chan	5	c8	a8	44-51	channel code
bmtyp	6	c4	a4	53-56	beam type
sproid	7	i4	i8	58-65	signal processor identifier
cfreq	8	f4	f7.2	67-73	center frequency
seaz	9	f4	f7.2	75-81	observed azimuth
delaz	10	f4	f7.2	83-89	delta azimuth
slow	11	f4	f7.2	91-97	observed slowness
delslo	12	f4	f7.2	99-105	delta slowness
snr	13	f4	f10.2	107-116	signal-to-noise ratio
stav	14	f4	f11.5	118-128	short-term average
fstat	15	f4	f5.2	130-134	f statistic
deltim	16	f4	f6.3	136-141	delta time
bandw	17	f4	f7.3	143-149	bandwidth
fkqual	18	i4	i4	151-154	fk quality
commid	19	i4	i8	156-163	comment identifier
lddate	20	date	a17	165-181	load date

Relation:	**disassoc**				
Description:	Associations in discarded ESAL working origins				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
disorid	1	i4	i8	1-8	dissolved origin identifier
arid	2	i4	i8	10-17	arrival identifier
timedef	3	c1	a1	19-19	time-defining flag
azdef	4	c1	a1	21-21	azimuth-defining flag
slodef	5	c1	a1	23-23	slowness-defining flag
lddate	6	date	a17	25-41	load date

Relation:	**disorigin**				
Description:	Discarded ESAL working origins				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
disorid	1	i4	i8	1-8	dissolved origin identifier
orid	2	i4	i8	10-17	origin identifier from analyst-formed event
koid	3	i4	i8	19-26	knowledge object identifier
toameth	4	c12	a12	28-39	trial origin method
lddate	5	date	a17	41-57	load date

Relation:	**eventid**				
Description:	Event identification and confidence				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
orid	1	i4	i8	1-8	origin identifier
etype	2	c7	a7	10-16	event type
mcode	3	c6	a6	18-23	mine code
conf	4	f4	f5.3	25-29	confidence
method	5	c15	a15	31-45	event identifier method
auth	6	c15	a15	47-61	author
lddate	7	date	a17	63-79	load date

Relation:	ev_summary				
Description:	Summary of analyst event locations				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
orid	1	i4	i8	1-8	origin identifier of analyst event
nearsta	2	c6	a6	10-15	code for nearest station
neardist	3	f4	f8.3	17-24	distance to closest station
nearaz	4	f4	f7.2	26-32	azimuth from nearest station
refid	5	i4	i8	34-41	identifier of nearest reference point
refdist	6	f4	f8.3	43-50	distance to nearest reference point
refaz	7	f4	f7.2	52-58	azimuth to nearest reference point
grn	8	i4	i8	60-67	geographic region number
nsta	9	i4	i8	69-76	number of recording stations
lsta	10	i4	i8	78-85	number of local observations
asta	11	i4	i8	87-94	number of regional array observations
rsta	12	i4	i8	96-103	number of non-array regional observations
tsta	13	i4	i8	105-112	number of teleseismic observations
ndef	14	i4	i4	114-117	number of time-defining phases
adef	15	i4	i8	119-126	number of associated non-defining phases
primp	16	i4	i8	128-135	number of primary time-defining phases used for location
secondp	17	i4	i8	137-144	number of secondary phases used for location
depthp	18	i4	i8	146-153	number of depth phases
lddate	19	date	a17	155-171	load date

Relation:	**ex_an**				
Description:	Comparison of analyst event solutions and associated expert system solutions				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
forid	1	i4	i8	1-8	final origin identifier
eorid	2	i4	i8	10-17	expert system origin identifier
ddist	3	f4	f8.3	19-26	distance between *forid* and *eorid*
ddepth	4	f4	f6.1	28-33	depth difference
dtime	5	f4	f8.3	35-42	origin time difference
did	6	c4	a4	44-47	identification difference
dnsta	7	i4	i8	49-56	difference in recording stations
dlsta	8	i4	i8	58-65	difference in local stations
dasta	9	i4	i8	67-74	difference in regional array stations
drsta	10	i4	i8	76-83	difference in non-array regional stations
dtsta	11	i4	i8	85-92	difference in teleseismic stations
dndef	12	i4	i8	94-101	difference in defining phases
dprimp	13	i4	i8	103-110	difference in primary phases
dsecondp	14	i4	i8	112-119	difference in secondary phases
ddepthp	15	i4	i8	121-128	difference in depth phases
rprimp	16	i4	i8	130-137	renamed primary phases
rsecondp	17	i4	i8	139-146	renamed secondary phases
rdepthp	18	i4	i8	148-155	renamed depth phases
added	19	i4	i8	157-164	number of added phases
retime	20	i4	i8	166-173	number of retimed phases
splitev	21	c4	a4	175-178	split event (y/n)
multev	22	c4	a4	180-183	multiple events (y/n)
kbscause	23	c7	a7	185-191	knowledge system explanation
lddate	24	date	a17	193-209	load date

Relation:	**fkdisc**				
Description:	Contents of frequency-wave number (.fk) file				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
jdate	1	i4	i8	1-8	julian date
time	2	f8	f17.5	10-26	epoch time
tlen	3	f4	f6.2	28-33	time window
stc	4	c6	a6	35-40	station code
fktyp	5	c4	a4	42-45	fk type
arid	6	i4	i8	47-54	arrival identifier
maxkx	7	f4	f7.4	56-62	maximum x-wavenumber
maxsx	8	f4	f7.4	64-70	maximum x-slowness
nx	9	i4	i4	72-75	number of x-samples
maxky	10	f4	f7.4	77-83	maximum y-wavenumber
maxsy	11	f4	f7.4	85-91	maximum y-slowness
ny	12	i4	i4	93-96	number of y-samples
cfreq	13	f4	f7.2	98-104	center frequency
bandw	14	f4	f7.3	106-112	bandwidth
commid	15	i4	i8	114-121	comment identifier
fkrid	16	i4	i8	123-130	fk recipe identifier
fkid	17	i4	i8	132-139	fk identifier
datsw	18	i4	i10	141-150	data switch
foff	19	i4	i10	152-161	byte offset in file
dir	20	c64	a64	163-226	fk directory
dfile	21	c32	a32	228-259	fk data file
lddate	22	date	a17	261-277	load date

Relation:	**fsdisc**				
Description:	Contents of Fourier spectrum (.fs) file				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
jdate	1	i4	i8	1-8	julian date
time	2	f8	f17.5	10-26	epoch time
tlen	3	f4	f6.2	28-33	time window
sta	4	c6	a6	35-40	station code
fstyp	5	c4	a4	42-45	Fourier spectrum type
arid	6	i4	i8	47-54	arrival identifier
maxf	7	f4	f9.4	56-64	maximum frequency
nf	8	i4	i4	66-69	number of frequency values
chanid	9	i4	i8	71-78	channel identifier
wfid	10	i4	i8	80-87	waveform identifier
commid	11	i4	i8	89-96	comment identifier
fsrid	12	i4	i8	98-105	fs recipe identifier
fsid	13	i4	i8	107-114	Fourier spectrum identifier
datsw	14	i4	i10	116-125	data switch
foff	15	i4	i10	127-136	byte offset in file
dir	16	c64	a64	138-201	Fourier spectrum directory
dfile	17	c32	a32	203-234	Fourier spectrum data file
lddate	18	date	a17	236-252	load date

Relation:	**kaudit**				
Description:	Audit trail relating a data object with a knowledge object				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
audid	1	i4	a8	1-8	audit identifier
dobjtype	2	c2	a2	10-11	data-object type (arrival, stassoc, origin)
dobjid	3	i4	i8	13-20	data-object identifier
koid	4	i4	i8	22-29	knowledge-object identifier
validatorid	5	i4	i8	31-38	validator identifier
validation	6	c2	a2	40-41	validation code
vdate	7	date	a17	43-59	validation date
lddate	8	date	a17	61-77	load date

Relation:	**kbscause_xpl**				
Description:	Explanation for the difference between the expert system and analyst location solutions				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
code	1	c7	a7	1-7	explanation code
description	2	c255	a255	9-263	explanation text

Relation:	**knowlobj**				
Description:	Description of knowledge object				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
koid	1	i4	i8	1-8	knowledge-object identifier
name	2	c64	a64	10-73	knowledge-object name
class	3	c64	a64	75-138	knowledge-object class
srcref	4	c64	a64	140-203	source-code reference
explan	5	long	a1024	205-1228	explanation
lddate	6	date	c17	1230-1246	load date

Relation:	**koconst**				
Description:	Name and value of constants used in knowledge objects				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
koid	1	i4	i8	1-8	knowledge-object identifier
name	2	c64	a64	10-73	constant name
value	3	c16	a16	75-90	constant value
lddate	4	date	a17	92-108	load date

Relation:	**koparamdesc**				
Description:	Descriptions of koconst and kovar parameters				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
name	1	c64	a64	1-64	parameter name
description	2	c255	a255	66-320	description
lddate	3	date	a17	322-338	load date

Relation:	**kovar**				
Description:	Name and value of variables used for each audit record				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
audid	1	i4	i8	1-8	audit identifier
name	2	c64	a64	10-75	variable name
value	3	c16	a16	75-90	value
lddate	4	date	a17	92-108	load date

Relation:	**mag_coefs**				
Description:	Coefficients for calculating regional magnitudes				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
sta	1	c6	a6	1-6	station
chan	2	c8	a8	8-15	channel
phase	3	c8	a8	17-24	phase
a	4	f4	f7.2	26-32	scaling constant
b	5	f4	f7.2	34-40	attenuation coefficient
c	6	f4	f7.2	42-48	geometrical spreading coefficient
sd	7	f4	f7.2	50-56	estimated standard deviation
lddate	8	date	a17	58-74	load date

Relation:	**mapcolor**				
Description:	Link between the mapdisc and colordisc relation tables				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
mapid	1	i4	i8	1-8	map identifier
colormapid	2	i4	i8	10-17	colormap identifier
lddate	3	date	a17	19-35	load date

Relation:	**mapdisc**				
Description:	Map file header and descriptive information				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
mapid	1	i4	i8	1-8	map identifier
mapname	2	c64	a64	10-73	map name
dfile	3	c32	a32	75-106	map data file name
dir	4	c64	a64	108-171	directory
maptype	5	i4	i8	173-180	map type
mapfiletype	6	c4	a4	182-185	map file type
projection	7	i4	i8	187-194	map projection
dimx	8	i4	i8	196-203	map x dimension
dimy	9	i4	i8	205-212	map y dimension
reflon	10	f4	f9.4	214-222	reference longitude
reflat	11	f4	f9.4	224-232	reference latitude
refoffsetlon	12	f4	f9.4	234-242	longitude reference offset
refoffsetlat	13	f4	f9.4	244-252	latitude reference offset
lonorigradians	14	f4	f9.4	254-262	longitude origin radians
latorigradians	15	f4	f9.4	264-272	latitude origin radians
scale	16	f4	f9.4	274-282	map scale
rotation	17	f4	f9.4	284-292	map rotation
latminor	18	f4	f9.4	294-302	latitude interval for minor grid lines
latmajor	19	f4	f9.4	304-312	latitude interval for major grid lines
lonminor	20	f4	f9.4	314-322	longitude interval for minor grid lines
lonmajor	21	f4	f9.4	324-332	longitude interval for major grid lines
bordercolor	22	c32	a32	334-365	border color name
label	23	c65	a65	367-431	map category
lddate	24	date	a17	433-449	load date

Relation:	**mapover**				
Description:	Link between the mapdisc and overlaydisc tables				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
mapid	1	i4	i8	1-8	map identifier
overlayid	2	i4	i8	10-17	overlay identifier
lddate	3	date	a17	19-35	load date

Relation:	**mappoint**				
Description:	Labeled point data for the Map				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
lat	1	f4	f9.4	1-9	latitude
lon	2	f4	f9.4	11-19	longitude
mplabel	3	c65	a65	21-85	map point label
mptype	4	c20	a20	87-106	map point type
mpdescrip	5	c50	a50	108-157	map point description
lddate	6	date	a17	159-175	load date

Relation:	**mine**				
Description:	Locations of known mine sites				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
mcode	1	c6	a6	1-6	mine code
lat	2	f4	f9.4	8-16	latitude
lon	3	f4	f9.4	18-26	longitude
auth	4	c15	a15	28-42	author
mname	5	c15	a15	44-58	mine name
lddate	6	date	a17	60-76	load date

Relation:	**originamp**				
Description:	Amplitude measurements for origin records				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
orid	1	i4	i8	1-8	origin identifier
sta	2	c6	a6	10-15	station
chan	3	c8	a8	17-24	channel descriptor
phase	4	c8	a8	26-33	phase
amp	5	f4	f11.2	35-45	amplitude
per	6	f4	f7.2	47-53	period
delamp	7	f4	f11.2	55-65	amplitude uncertainty
amptime	8	f8	f17.5	67-83	time of amplitude measure
amptype	9	c8	a8	85-92	amplitude measure descriptor
lddate	10	date	a17	94-110	load date

Relation:	**overlaydisc**				
Description:	Overlay file header and descriptive information				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
overlayid	1	i4	i8	1-8	overlay identifier
overlayname	2	c64	a64	10-73	overlay name
dfile	3	c32	a32	75-106	data file name
dir	4	c64	a64	108-171	directory
colorname	5	c32	a32	173-204	overlay color name
lddate	6	date	a17	206-222	load date

Relation:	**perfV_arid_mappings**				
Description:	Results of PerfV's arid match				
attribute name	**field no.**	**storage typ**	**external format**	**character positions**	**attribute description**
arid1	1	i4	i8	1-8	arrival identifier from first account
arid2	2	i4	i8	10-17	arrival identifier from second account
lddate	3	date	a17	19-35	load date

Relation:	**refarea**				
Description:	Reference area and processing parameters for mine characterization				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
raid	1	i4	i8	1-8	reference area identifier
refname	2	c16	a16	10-25	name of reference area
minlat	3	f4	f9.4	27-35	minimum latitude of reference area
maxlat	4	f4	f9.4	37-45	maximum latitude of reference area
minlon	5	f4	f9.4	47-55	minimum longitude of reference area
maxlon	6	f4	f9.4	57-65	maximum longitude of reference area
sta	7	c6	a6	67-72	defining station
chan	8	c8	a8	74-81	defining channel
sbar	9	f4	f7.3	83-89	seconds before arrival to start time window
saar	10	f4	f7.3	91-97	seconds after arrival to end time window
typwindow	11	c10	a10	99-108	type of tapering window
nwindow	12	i4	i8	110-117	number of windows
lfcorner	13	i4	i8	119-126	low frequency corner of filter
hfcorner	14	i4	i8	128-135	high frequency corner of filter
params	15	c80	a80	137-216	other processing parameters
lddate	16	date	a17	218-234	load date

Relation:	**refevent**				
Description:	Reference events for mine characterization				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
raid	1	i4	i8	1-8	reference area identifier
reid	2	i4	i8	10-17	reference event identifier
wfid	3	i4	i8	19-26	reference waveform identifier
arid	4	i4	i8	28-35	arrival identifier
sta	5	c6	a6	37-42	station
chan	6	c8	a8	44-51	channel
phase	7	c8	a8	53-60	phase name
etype	8	c7	a8	62-69	event type
minid	9	i4	i8	71-78	mine identifier
active	10	i4	i8	80-87	flag indicating if this event should be used
lat	11	f4	f94	89-97	latitude of the reference event
lon	12	f4	f94	99-107	longitude of the reference event
lddate	13	date	a17	109-125	load date

Relation:	**refout**				
Description:	Cross-correlation output from mine characterization				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
orid	1	i4	i8	1-8	origin identifier used in processing
reid	2	i4	i8	10-17	reference event identifier
xcor	3	f4	f9.4	19-27	cross-correlation value
commid	4	i4	i8	29-36	comment identifier
lddate	5	date	a17	38-54	load date

Relation:	**ref_loc**				
Description:	Reference locations for comparing origins to known geographic locations				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
refid	1	i4	i8	1-8	reference location identifier
refname	2	c16	a16	10-25	reference location name
lat	3	f4	f9.4	27-35	latitude
lon	4	f4	f9.4	37-45	longitude
descrip	5	c80	a80	47-126	description
lddate	6	date	a17	128-144	load date

Relation:	**sbsnr**				
Description:	Amplitudes measured on standard beam				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
arid	1	i4	i8	1-8	arrival identifier
sta	2	c6	a6	10-15	station
chan	3	c8	a8	17-24	channel
stav	4	f4	f11.5	26-36	maximum short-term average in window
ltav	5	f4	f11.5	38-48	long-term average at detection time
lddate	6	date	a17	50-66	load date

Relation:	**script**				
Description:	Scripts for specific source-receiver paths				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
scid	1	i4	i8	1-8	script identifier
sta	2	c6	a6	10-15	station code
phase	3	c8	a8	17-24	phase
atname	4	c10	a10	26-35	attribute name
amean	5	f4	f9.4	37-45	attribute mean
astd	6	f4	f9.4	47-55	attribute standard deviation
awgt	7	f4	f5.2	57-61	attribute weight
amin	8	f4	f9.4	63-71	minimum value of attribute
amax	9	f4	f9.4	73-81	maximum value of attribute
lddate	10	date	a17	83-99	load date

Relation:	**scriptloc**				
Description:	Source locations and information for each script				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
scid	1	i4	i8	1-8	script identifier
mcode	2	c6	a6	10-15	mine code
lat	3	f4	f9.4	17-25	latitude
lon	4	f4	f9.4	27-35	longitude
descr	5	c20	a20	37-56	text description
lddate	6	date	a17	58-74	load date

Relation:	**seisgrid**				
Description:	Geographical grid of natural seismicity				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
grdname	1	c6	a6	1-6	grid name
icell	2	i4	i8	8-15	grid cell index
magth	3	f4	f7.2	17-23	magnitude threshold
magtype	4	c6	a6	25-30	magnitude type
nevyr	5	f4	f9.2	32-40	average number of events/year
lddate	6	date	a17	42-58	load date

Relation:	**seisindex**				
Description:	Index for geographical seismicity grid				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
grdname	1	c6	a6	1-6	grid name
latl	2	f4	f9.4	8-16	initial latitude
lonl	3	f4	f9.4	18-26	initial longitude
dlat	4	f4	f9.4	28-36	latitude increment
dlon	5	f4	f9.4	38-46	longitude increment
nlat	6	i4	i8	48-55	number of latitudes
nlon	7	i4	i8	57-64	number of longitudes
orderby	8	c6	a6	66-71	order by (either latitude or longitude)
lddate	9	date	a17	73-89	load date

Relation:	**siteaux**				
Description:	Auxiliary site-dependent parameters				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
sta	1	c6	a6	1-6	station code
chan	2	c8	a8	8-15	channel code
time	3	f8	f17.5	17-33	epoch time
nois	4	f4	f10.1	35-44	noise amplitude
noissd	5	f4	f5.2	46-50	standard deviation of log noise
amcor	6	f4	f10.1	52-61	amplitude correction
amcorsd	7	f4	f5.2	63-67	standard deviation of amplitude correction
snthrsh	8	f4	f5.2	69-73	signal/noise detection threshold
rely	9	f4	f5.2	75-79	station reliability
ptmcor	10	f4	f6.3	81-86	P arrival time correction
stmcor	11	f4	f6.3	88-93	S arrival time correction
staper	12	f4	f5.2	95-99	period for measurements
auth	13	c15	a15	101-115	author
commid	14	i4	i8	117-124	comment identifier
lddate	15	date	a17	126-142	load date

Relation:	**smatch**				
Description:	Results of the script match				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
scid	1	i4	i8	1-8	script identifier
orid	2	i4	i8	10-17	origin identifier
nsta	3	i4	i4	19-22	number of stations
nphase	4	i4	i4	24-27	number of phases
ndegf	5	i4	i4	29-32	number of degrees of freedom
fchisq	6	f4	f6.3	34-39	F[chi-squared]
lddate	7	date	a17	41-57	load date

Relation:	**smatchvar**				
Description:	Script match results for each attribute				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
scid	1	i4	i8	1-8	script identifier
orid	2	i4	i8	10-17	origin identifier
atname	3	c10	a10	19-28	attribute name
sta	4	c6	a6	30-35	station code
phase	5	c8	a8	37-44	phase name
mval	6	f4	f9.4	46-54	measured value of attribute
sval1	7	f4	f9.4	56-64	script value 1
sval2	8	f4	f9.4	66-74	script value 2
sconf	9	f4	f9.4	76-84	script confidence
lddate	10	date	a17	86-102	load date

Relation:	**spvar**				
Description:	Variance of the detrended log spectrum for each phase associated with an event				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
arid	1	i4	i8	1-8	arrival identifier
fsid	2	i4	i8	10-17	Fourier spectrum identifier
acoef	3	f4	f7.2	19-25	"a" coefficient for non-linear trend
bcoef	4	f4	f7.2	27-33	"b" coefficient for non-linear trend
ccoef	5	f4	f7.2	35-41	"c" coefficient for non-linear trend
fmin	6	f4	f7.2	43-49	minimum frequency
fmax	7	f4	f7.2	51-57	maximum frequency
svar	8	f4	f7.2	59-65	variance of detrended log spectrum
lddate	9	date	a17	67-83	load date

Relation:	**summary_admin**				
Description:	Administration table for PerfV's summary tables				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
expert	1	c50	a50	1-50	name of Expert (KBS) account
analyst	2	c50	a50	52-101	name of analyst database account
begin_time	3	c30	a30	103-132	begin time
end_time	4	c30	a30	134-163	end time
lddate	5	date	a17	165-181	load date

Relation:	**timestamp**				
Description:	Time stamp used for IMS processing				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
procclass	1	c16	a16	1-16	process class
procname	2	c16	a16	18-33	process name
time	3	f8	f17.5	35-51	last epoch time
lddate	4	date	a17	53-69	load date

Relation:	**validator**				
Description:	Validator reference				
attribute name	**field no.**	**storage type**	**external format**	**character positions**	**attribute description**
validatorid	1	i4	i8	1-8	validator identifier
validator	2	c64	a64	10-73	validator

IV. IMS Database Relations

This section describes the IMS relations that extend the Center for Seismic Studies Version 3 Schema. The attributes of each relation are italicized and arranged in the following order: Keys, Convenience, Data.

- Key attributes provide the links by which relations are joined (for a detailed explanation, see Chapter 3 of the *Center for Seismic Studies Version 3 Database: Schema Reference Manual*).
- Convenience attributes are redundant data whose primary home is another relation, but are included in this table for the sake of convenience.
- Data attributes are split into three categories: Descriptive, Measurement and Administrative.

This section is organized in the following format.

Name:	**Name of the relation.**	
Keys:	Primary.	*These are the attributes which, taken together, uniquely identify a row in the table.*
	Alternate.	*These are other attributes which also uniquely identify a row and may be used as primary keys.*
	Foreign.	*These attributes are primary keys in another table.*
Convenience:	Attributes in this class, if any, are data-attributes in another table.	
Data:	Descriptive.	*Qualitative attributes.*
	Measurement.	*Quantitative attributes.*
	Administrative.	*Attributes used for database administration.*

The information given here, along with that in Section V., IMS Database Attributes, constitutes the data dictionary.

Name:	**ampdescript**	
Keys:	Primary.	*amptype*
Data:	Descriptive.	*descr, mtype*
	Measurement.	*toff, tlen, gvlo, gvhi*
	Administrative.	*lddate*
Description:	Description of how the amplitude measurements in **arrivalamp** and **originamp** were made (time offsets, group velocity window, measurement types, etc.).	

Name:	**apma**	
Keys:	Primary.	*arid*
	Foreign.	*commid*
Data:	Descriptive.	*phase*
	Measurement.	*freq, snr, ampp, amps, amplr, rect, plans, planlr, hvratp, hvrat, hmxmn, inang3, seazp, seazs, seazlr, inang1, ptime, stime*
	Administrative.	*apmarid, auth, lddate*
Description:	Results of particle motion analysis [Jurkevics, 1988]. The polarization ellipse is computed for overlapping time windows by solving the eigenvalue problem for the covariance matrix. The covariance matrices are computed in the time domain for several frequency bands, and then normalized and averaged to obtain a wide-band estimate for each of the overlapping windows. The three eigenvalues are ordered such that $\lambda_1 \geq \lambda_2 \geq \lambda_3$, and their associated eigenvectors are e_1, e_2, and e_3. P-type attributes are calculated from the time window with the maximum rectilinearity, and S-type attributes are calculated from the time window with the maximum 3-component amplitude. The S-type attributes are divided into S and Rayleigh (LR) attributes. Many of the attributes are averages for several overlapping time windows. The number of overlapping time windows is specified in a recipe file, and can be different for S and LR. The IMS implementation of the particle motion analysis is described by Bache *et al.* 1990.	

Name:	**arrivalamp**	
Keys:	Primary.	*arid, amptype, chan*
Data:	Descriptive.	*inarrival, amptime*
	Measurement.	*amp, per, delamp*
	Administrative.	*lddate*
Description:	Arrival-based amplitude measurements. The amplitude measurement is described in **ampdescript** and *chan* refers to the channel on which the amplitude and period are measured.	

Name:	**audit_admin**	
Keys:	Primary.	*expert, analyst, begin_time, end_time*
Data:	Administrative.	*lddate*
Description:	Administrative table for audit trail analysis. This table stores the time intervals and database accounts for PerfV's audit trail analysis. No indexes are recommended for this table.	

Name:	**bull_comp**	
Keys:	Primary.	*orid1, orid2*
Data:	Descriptive.	*asstr*
	Measurement.	*ddist, ddepth, dtime, ndef1, ndef2, dndef, narr1, narr2, dnarr, nmatch, ndef1arr2, ndef2arr1*
	Administrative.	*lddate*
Description:	Results of comparing two seismic bulletins using PerfV's *Bulletin Comparison* application. The data in this table summarize the differences between event solutions which share common associated arrivals, or (if no arrival information is available) whose locations and time uncertainties overlap.	

Name:	**bull_comp_admin**	
Keys:	Primary.	*expert1, expert2, begin_time, end_time*
Data:	Measurement.	*nmorid, nmoridw, norid1, norid2*
	Administrative.	*lddate*
Description:	Administrative table for PerfV's *Bulletin Comparison.* This table stores the time intervals and database accounts for PerfV's *Bulletin Comparison.*	

Name:	**ceppks**	
Keys:	Primary.	*orid, sta, ptyp*
Data:	Measurement.	*pkamp, pkqf*
	Administrative.	*lddate*
Description:	Results of cepstral analysis. Includes the amplitude and quefrency of cepstral peaks that are consistent among multiple phases associated with the same event. These results are used in Event Identification.	

Name:	**colordisc**	
Keys:	Primary.	*colormapid*
Data:	Descriptive.	*colormapname, dfile, dir*
	Administrative.	*lddate*
Description:	Links a unique *colormapid* to a colormap name and disk file.	

Name:	**detection**	
Keys:	Primary.	*sta, chan, time*
	Alternate.	*arid*
	Foreign.	*commid*
Convenience:	*jdate*	
Data:	Descriptive.	*bmtype*
	Measurement.	*cfreq, seaz, delaz, slow, delslo, snr, stav, fstat, deltim, bandw, fkqual*
	Administrative.	*sproid, lddate*
Description:	Attributes describing a detected seismic signal with emphasis on characterizing automated signal detections from arrays. Much of the information in this table is duplicated in the Version 3 **arrival** table or can be represented in the **arrivalamp** table. This table will be replaced by a new table called **arrivalaux**, but the structure of this new table has not been finalized.	

Name:	**disassoc**	
Keys:	Primary.	*disorid, arid*
Data:	Measurement.	*timedef, azdef, slodef*
	Administrative.	*lddate*
Description:	Associations in discarded ESAL working origins. This table is linked with **disorigin** by *disorid.* For each arrival that was associated with an origin that was discarded by ESAL, it includes information regarding which attributes were defining (e.g., time, azimuth and slowness).	

Name:	**disorigin**	
Keys:	Primary.	*disorid*
	Foreign.	*orid, koid*
Data:	Descriptive.	*toameth*
	Administrative.	*lddate*
Description:	Discarded ESAL working origins. The corresponding analyst *orid* is written to this table (if one exists) by PerfV's audit trail analysis. This is used to monitor failed event hypotheses and is useful for identifying the cause of missed events.	

Name:	**eventid**	
Keys:	Primary.	*orid, method*
Data:	Descriptive.	*etype, mcode*
	Measurement.	*conf*
	Administrative.	*auth, lddate*
Description:	Event identification determined by each discriminant, and the final composite event identification. The results of automated event identification are written to **in_eventid**, and the results after analyst review are written to **out_eventid**.	

Name:	**ev_summary**	
Keys:	Primary.	*orid*
	Foreign.	*grn, refid*
Data:	Descriptive.	*nearsta*
	Measurement.	*neardist, nearaz, refdist, refaz, nsta, lsta, asta, rsta, tsta, ndef, adef, primp, secondp, depthp*
	Administrative.	*lddate*
Description:	Summary of event location solutions in the analyst bulletin. The attributes include number of stations, number of defining phases, distance to the nearest station, and other information to characterize the event location solution. This table has the same structure as **ex_summary**, which is used to summarize ESAL's location solutions.	

Name:	**ex_an**	
Keys:	Primary.	*forid*
	Alternate.	*eorid*
Data:	Descriptive.	*kbscause*
	Measurement.	*ddist, ddepth, dtime, did, dnsta, dlsta, dasta, drsta, dtsta, dndef, dprimp, dsecondp, ddepthp, rprimp, rsecondp, rdepthp, added, retime, splitev, multev*
	Administrative.	*lddate*
Description:	Comparison of the expert system and analyst location solutions. The comparison includes location differences, phase association differences, and information about split and multiple events. The analyst/expert associates are sorted according to the strength of the association (see *asstr*) and distance. Inferior associates are removed so that only the best association is retimed for each event.	

Name:	**fkdisc**	
Keys:	Primary.	*fkid*
	Alternate.	*arid*
	Foreign.	*commid*
Convenience:	*jdate*	
Data:	Descriptive.	*sta, datsw, foff, dir, dfile, time, tlen, fktyp, maxkx, maxsx, nx, maxky, maxsy, ny, cfreq, bandw*
	Administrative.	*fkrid, lddate*
Description:	Describes the contents of a frequency-wavenumber disk file.	

Name:	**fsdisc**	
Keys:	Primary.	*fsid*
	Alternate.	*arid*
	Foreign.	*commid, chanid, wfid*
Convenience:	*jdate*	
Data:	Descriptive.	*sta, datsw, fstyp, foff, dir, dfile, time, tlen, maxf, nf*
	Administrative.	*fsrid, lddate*
Description:	Describes the contents of a Fourier spectrum disk file.	

Name:	**kaudit**	
Keys:	Primary.	*audid*
	Foreign.	*dobjid, koid, validatorid*
Data:	Descriptive.	*dobjtype*
	Measurement.	*validation*
	Administrative.	*vdate, lddate*
Description:	Basic audit record that relates a data object (arrival, stassid group, origin) with a knowledge-object. Knowledge-objects are described in the **knowlobj** table. The audit trail analysis module of PerfV populates the validation field by comparing the expert system and analyst bulletins.	

Name:	**kbscause_xpl**	
Keys:	Primary.	*code*
Data:	Descriptive.	*description*
Description:	Lookup table for explanations of the likely cause of discrepancies between the expert system and the analyst location solutions. The *code* attribute is a link to the *kbscause* attribute in the **ex_an** table.	

Name:	**knowlobj**	
Keys:	Primary.	*koid*
Data:	Descriptive.	*name, class, srcref, explan*
	Administrative.	*lddate*
Description:	Description of knowledge-objects used in audit trail analysis.	

Name:	**koconst**	
Keys:	Primary.	*koid*
Data:	Descriptive.	*name*
	Measurement.	*value*
	Administrative.	*lddate*
Description:	The name and value of constants used in knowledge-objects indexed by *koid*. This table has not yet been implemented in IMS code.	

Name:	**koparamdesc**	
Keys:	Primary.	*name*
Data:	Descriptive.	*description*
	Administrative.	*lddate*
Description:	Description of the parameter names used in tables **kovar** and **koconst**. This table has not yet been implemented in IMS code.	

Name:	**kovar**	
Keys:	Primary.	*audid*
Data:	Descriptive.	*name*
	Measurement.	*value*
	Administrative.	*lddate*
Description:	The name and value of variables that were used for each audit record. This table has not yet been implemented in IMS code.	

Name:	**mag_coefs**	
Keys:	Primary.	*sta, chan, phase*
Data:	Measurement.	*a, b, c, sd*
	Administrative.	*lddate*
Description:	Coefficients required to calculate magnitudes for regional seismic events. The current IMS implementation applies these coefficients to 2-4 Hz short-term-average (*stav*) amplitudes.	

Name:	**mapcolor**	
Keys:	Primary.	*mapid, colormapid*
Data:	Administrative.	*lddate*
Description:	This table associates a *mapid* from the **mapdisc** table with a *colormapid* from the **colordisc** table. This is used to plot the same map (*mapid*) in different colors (e.g., brown, green, or outline).	

Name:	**mapdisc**	
Keys:	Primary.	*mapid*
Data:	Descriptive.	*mapname, dfile, dir, maptype, mapfiletype, projection, bordercolor, label*
	Measurement.	*dimx, dimy, reflon, reflat, refoffsetlon, refoffsetlat, lonorigradians, latorigradians, scale, rotation, latminor, latmajor, lonminor, lonmajor*
	Administrative.	*lddate*
Description:	Describes map files that are on disk.	

Name:	**mapover**	
Keys:	Primary.	*mapid, overlayid*
Data:	Administrative.	*lddate*
Description:	This table associates a *mapid* from the **mapdisc** table with an *overlayid* from the **overlaydisc** table.	

Name:	**mappoint**	
Keys:	Primary.	*lat, lon, mptype*
Data:	Descriptive.	*mpdescrip*
	Measurement.	*mplabel*
	Administrative.	*lddate*
Description:	Labeled point data to be displayed by the IMS Map program (e.g., mine locations).	

Name:	**mine**	
Keys:	Primary.	*mcode*
Data:	Descriptive.	*mname*
	Measurement.	*lat, lon*
	Administrative.	*auth, lddate*
Description:	Locations, names, codes and source of information for known mine sites.	

Name:	**originamp**	
Keys:	Primary.	*orid, chan, amptype, amptime, phase*
Data:	Descriptive.	*sta*
	Measurement.	*amp, per, delamp*
	Administrative.	*lddate*
Description:	Origin-based amplitude measurements. The amplitude measurement type is described in **ampdescript**. *chan* refers to the channel or beam on which the amplitude and period are measured (the channel description is not currently in the database). This table is used, for example, for amplitude measurements made over time windows derived from an event location solution.	

Name:	**overlaydisc**	
Keys:	Primary.	*overlayid*
Data:	Descriptive.	*overlayname, dfile, dir, colorname*
	Administrative.	*lddate*
Description:	Describes map overlay files that are on disk.	

Name:	**perfV_arid_mappings**	
Keys:	Primary.	*arid1, arid2*
Data:	Administrative.	*lddate*
Description:	Results of PerfV's arid match between the two input accounts if the arids are different in the two accounts. Only matching arid pairs are written to this table (no N/A values).	

Name:	**refarea**	
Keys:	Primary.	*raid*
Data:	Descriptive.	*refname, minlat, maxlat, minlon, maxlon, sta, chan, sbar, saar, typwindow, nwindow, lfcorner, hfcorner, params*
	Administrative.	*lddate*
Description:	Defines a reference area and processing parameters for mine characterization [Riviere and Grant, 1992].	

Name:	**refevent**	
Keys:	Primary.	*raid, reid*
	Foreign.	*wfid, arid*
Data:	Descriptive.	*sta, chan, phase, etype, minid, active, lat, lon*
	Administrative.	*lddate*
Description:	Describes reference events to be used in mine characterization [Riviere and Grant, 1992].	

Name:	**refout**	
Keys:	Primary.	*orid, reid*
	Foreign.	*commid*
Data:	Measurement.	*xcor*
	Administrative.	*lddate*
Description:	Cross-correlation output from mine characterization [Riviere and Grant, 1992].	

Name:	**ref_loc**	
Keys:	Primary.	*refid*
Data:	Descriptive.	*refname, descrip*
	Measurement.	*lat, lon*
	Administrative.	*lddate*
Description:	Provides reference locations for comparison of origins to known geographic locations.	

Name:	**sbsnr**	
Keys:	Primary.	*arid, sta, chan*
Data:	Measurement.	*stav, ltav*
	Administrative.	*lddate*
Description:	Signal and noise amplitudes measured on standard beams or channels (short-term-average signal amplitudes and long-term-average noise amplitudes). This table will be replaced by **arrivalamp**.	

Name:	**script**	
Keys:	Primary.	*scid*
Data:	Descriptive.	*sta, phase, atname*
	Measurement.	*amean, astd, awgt, amin, amax*
	Administrative.	*lddate*
Description:	Contains scripts for specific source-receiver pairs (e.g., mine sites). Used for case-based reasoning in the Event Identification System.	

Name:	**scriptloc**	
Keys:	Primary.	*scid*
Data:	Descriptive.	*mcode, lat, lon, descr*
	Administrative.	*lddate*
Description:	Source locations and information for each script in the table **script**. Used for case-based reasoning in the Event Identification System.	

Name:	**seisgrid**	
Keys:	Primary.	*grdname, icell*
Data:	Descriptive.	*magth, magtype*
	Measurement.	*nevyr*
	Administrative.	*lddate*
Description:	Natural seismicity grid. Contains the average number of events per year with magnitude greater than the threshold in this table for each lat-lon grid point (the grid points are defined in the **seisindex** table).	

Name:	**seisindex**	
Keys:	Primary.	*grdname*
Data:	Descriptive.	*lat1, lon1, dlat, dlon, nlat, nlon, orderby*
	Administrative.	*lddate*
Description:	Indexes the geographic grids of natural seismicity data in the **seisgrid** table.	

Name:	**siteaux**	
Keys:	Primary.	*sta, chan, time*
	Foreign.	*commid*
Data:	Measurement.	*nois, noissd, amcor, amcorsd, snthrsh, rely, ptmcor, stmcor, staper*
	Administrative.	*auth, lddate*
Description:	Auxiliary site-dependent parameters (e.g., site-specific noise amplitudes).	

Name:	**smatch**	
Keys:	Primary.	*scid, orid*
Data:	Measurement.	*nsta, nphase, ndegf, fchisq*
	Administrative.	*lddate*
Description:	Script match results. Characterizes how well an event matches a script that was derived from many events from the same location (e.g., mine sites).	

Name:	**smatchvar**	
Keys:	Primary.	*scid, orid, atname, sta, phase*
Data:	Measurement.	*mval, sval1, sval2, sconf*
	Administrative.	*lddate*
Description:	Script match attribute results. Characterizes how well each attribute from an event matches the corresponding attribute in a script that was derived from many events from the same location (e.g., mine sites).	

Name:	**spvar**	
Keys:	Primary.	*arid, fmin, fmax*
	Foreign.	*fsid*
Data:	Measurement.	*acoef, bcoef, ccoef, svar*
	Administrative.	*lddate*
Description:	Contains the variance of the detrended log spectrum between *fmin* and *fmax* for an arrival identified by *arid*. The frequency bandwidth is based on a signal-to-noise ratio criterion.	

Name:	**summary_admin**	
Keys:	Primary.	*expert, analyst, begin_time, end_time*
Data:	Administrative.	*lddate*
Description:	Administrative table which stores the time intervals and database accounts for PerfV's summary table module. No indexes are recommended for this table.	

Name:	**timestamp**	
Keys:	Primary.	*procclass, procname*
Data:	Descriptive.	*time*
	Administrative.	*lddate*
Description:	Time markers for keeping track of automated IMS processing.	

Name:	**validator**	
Keys:	Primary.	*validatorid*
Data:	Descriptive.	*validator*
Description:	Description of the *validator* for the audit trail table, **kaudit**.	

V. IMS Database Attributes

This section describes each of the attributes used in IMS extensions to the Center for Seismic Studies Version 3.0 Schema and follows the same conventions as Chapter 4 of the *Center for Seismic Studies Version 3 Database: Schema Reference Manual.*

Name: *a*
Relation: **mag_coefs**
Description: Logarithm of scaling constant for the magnitude parameterization: m = logA + a + bR + clog R, where A is the measured amplitude and R is epicentral distance in km.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: *a* > -999.0

Name: *acoef*
Relation: **spvar**
Description: Coefficient "a" of the quadratic trend of the log spectrum between frequencies *fmin* and *fmax*. The spectrum is measured in nm-sec.
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Range: Any floating point value

Name: *active*
Relation: **refevent**
Description: Flag indicating if this reference event should be used in the waveform comparison process. A reference event could be active if used in the comparison process, or inactive if this event has been replaced by a new reference event.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *active* $\subset$ [0,1]

Name: *added*
Relation: **ex_an**
Description: Number of phases added by an analyst to an expert system event solution. An added phase is an arrival not available to the expert system.
ORACLE: NUMBER(8)
NA Value: -1
Range: *added* ≥ 0

Name: *adef*
Relation: **ev_summary**
Description: Number of associated non-defining phases. The observations for these phases are not used in the location solution.
ORACLE: NUMBER(8)
NA Value: -1
Range: *adef* ≥ 0

Name: *amax*
Relation: **script**
Description: Maximum value of a script attribute.
ORACLE: FLOAT(24)
NA Value: -999.0 if this attribute is characterized by a mean and a standard deviation rather than a maximum and minimum.
Range: *amax*! > -999.0

Name: *amcor*
Relation: **siteaux**
Description: Site-dependent log amplitude correction.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: None
Range: *amcor* > -999.0

Name: *amcorsd*
Relation: **siteaux**
Description: Standard deviation for log amplitude correction.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: None
Range: *amcorsd* > 0.0

Name: *amean*
Relation: **script**
Description: Mean value of a script attribute.
ORACLE: FLOAT(24)
NA Value: -999.0 if this attribute is characterized by a maximum and minimum value rather than a mean and standard deviation.
Range: amean! > -999.0

Name: *amin*
Relation: **script**
Description: Minimum value of a script attribute.
ORACLE: FLOAT(24)
NA Value: -999.0 if this attribute is characterized by a mean and a standard deviation rather than a maximum and minimum
Range: amin! > -999.0

Name:	*amp*
Relation:	**arrivalamp, originamp**
Description:	Measured amplitude defined by *amptype*.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Nanometers or dimensionless depending on the type of channel.
Range:	*amp* > 0.0

Name:	*amplr*
Relation:	**apma**
Description:	Maximum 3-component amplitude for all overlapping time windows used in the polarization analysis. It is equal to the sum of the square roots of the eigenvalues. The only difference between *amps* and *amplr* is in the definition of the overlapping time windows.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Nanometers
Range:	*amplr* > 0.0

Name:	*ampp*
Relation:	**apma**
Description:	3-component amplitude measured at the time of the maximum rectilinearity. It is equal to the sum of the square roots of the eigenvalues (i.e., it is the sum of the amplitudes measured along the three axes of the polarization ellipsoid).
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Nanometers
Range:	*ampp* > 0.0

Name:	*amps*
Relation:	**apma**
Description:	Maximum 3-component amplitude for all overlapping time windows used in the polarization analysis. It is equal to the sum of the square roots of the eigenvalues. The only difference between *amps* and *amplr* is in the definition of the overlapping time windows.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Nanometers
Range:	*amps* > 0.0

Name: *amptime*
Relation: **arrivalamp, originamp**
Description: Time of amplitude measure.
ORACLE: FLOAT(53)
NA Value: -9999999999.999
Units: Seconds since midnight January 1, 1970
Range: *amptime* > -9999999999.999

Name: *amptype*
Relation: **ampdescript, arrivalamp, originamp**
Description: Amplitude measure descriptor. This descriptor is used to uniquely identify an amplitude measurement and link the description in *ampdescript* with actual measurements in *arrivalamp* and/or *originamp.*
ORACLE: VARCHAR(8)
NA Value: - (a dash)
Range: Any free-format string up to 8 characters

Name: *analyst*
Relation: **audit_admin, summary_admin**
Description: Name of the analyst database account.
ORACLE: VARCHAR(50)
NA Value: An entry in the valid range is required.
Range: Any free-format string up to 50 characters

Name: *apmarid*
Relation: **apma**
Description: Unique **apma** recipe identifier. Each arrival in **apma** is assigned a positive integer identifying it with the recipe used in the polarization analysis.
ORACLE: NUMBER(8)
NA Value: -1
Range: *apmarid* > 0

Name: *arid*
Relations: **apma, arrivalamp, detection, disassoc, fkdisc, fsdisc, sbsnr, spvar, refevent**
Description: Arrival identifier. Each arrival is assigned a unique positive integer identifying it with a unique *sta, chan* and *time.*
ORACLE: NUMBER(8)
NA Value: -1
Range: *arid* > 0

Name: *arid1*
Relations: **perfV_arid__mappings**
Description: Arrival identifier of the first (or expert system) account for a matching *arid* pair.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *arid1* > 0

Name: *arid2*
Relations: **perfV_arid__mappings**
Description: Arrival identifier of the second (or analyst) account for a matching *arid* pair.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *arid2* > 0

Name: *asstr*
Relation: **bull_comp**
Description: Association strength of two events: strong ("s") or weak ("w"). An origin (`origin1`) is strongly associated with an origin in the other database account (`origin2`) if: (1) ≥ 3 defining detections for `origin1` are also associated with `origin2`, or (2) all defining detections for `origin1` are also associated with `origin2`. If events are associated only by time and location (no arrivals available) then *asstr* is set to "w".
ORACLE: CHAR(1)
NA Value: - (a dash). This is allowed only for events analyzed before this attribute was computed.
Range: "s" or "w"

Name: *asta*
Relation: **ev_summary**
Description: Number of associated arrivals from regional arrays. "Regional" is currently defined as a station-event distance not less than 250 km and up to 2,000 km.
ORACLE: NUMBER(8)
NA Value: -1
Range: *asta* ≥ 0

Name: *astd*
Relation: **script**
Description: Standard deviation of a script attribute.
ORACLE: FLOAT(24)
NA Value: -999.0 if this attribute is characterized by a maximum and minimum value rather than a mean and standard deviation.
Range: *astd* > -999.0

Name:	*atname*
Relation:	**script, smatchvar**
Description:	Name of a script attribute (e.g., *reltim*, *relamp*, *per*, *azimuth*, *rect*, *tofday*).
ORACLE:	VARCHAR(10)
NA Value:	- (a dash)
Range:	Any free-format string up to 10 characters

Name:	*audid*
Relation:	**kaudit, kovar**
Description:	Unique identifier of an audit record.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*audid* > 0

Name:	*auth*
Relations:	**apma, eventid, mine, siteaux**
Description:	Author. This records the originator of the data in a tuple. *auth* may also identify an application generating the record, such as an automated interpretation or signal processing program.
ORACLE:	VARCHAR(15)
NA Value:	- (a dash)
Range:	Any string up to 15 characters

Name:	*awgt*
Relation:	**script**
Description:	Weight assigned to the script attribute in the chi-squared test.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Range:	$0 \leq \text{awgt} \leq 1$

Name:	*azdef*
Relation:	**disassoc**
Description:	Azimuth defining code. The one character flag indicates whether or not the azimuth of a phase was used to constrain the events location solution. It is defining (*azdef* = "d") if it was in the location, or non-defining (*azdef* = "n") if it is not used.
ORACLE:	VARCHAR(1)
NA Value:	- (a dash)
Range:	"d" or "n"

Name: *b*
Relation: **mag_coefs**
Description: Attenuation coefficient in the magnitude parameterization: m = logA + a + bR + clogR, where A is the measured amplitude and R is the epicentral distance in km.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $b > 0.0$

Name: *bandw*
Relation: **detection, fkdisc**
Description: Frequency bandwidth for a beam or f-k spectrum.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Hertz
Range: $bandw > 0.0$

Name: *bcoef*
Relation: **spvar**
Description: Coefficient "b" of the quadratic trend of the log spectrum between frequencies *fmin* and *fmax*. The spectrum is measured in nm-sec.
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Range: Any floating point value

Name: *begin_time*
Relation: **audit_admin, bull_comp_admin, summary_admin**
Description: Beginning time of comparison/processing.
ORACLE: VARCHAR(30)
NA Value: An entry in the valid range is required.
Range: Any valid date

Name: *bmtyp*
Relation: **detection**
Description: String indicating a coherent ("coh"), incoherent ("inc"), or horizontal ("hor") beam type.
ORACLE: VARCHAR(4)
NA Value: - (a dash)
Range: {coh | inc | hor}

Name:	*bordercolor*
Relations:	**mapdisc**
Description:	Map border color name. A solid colored border may appear on the top, bottom and right of any raster map.
ORACLE:	VARCHAR(32)
NA Value:	- (a dash)
Range:	Any string up to 32 characters which forms valid X color name (e.g., "black").

Name:	*c*
Relation:	**mag_coefs**
Description:	Geometrical spreading coefficient in the magnitude parameterization: m = logA + a + bR + clogR, where A is the measured amplitude and R is the epicentral distance in km.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Range:	$c \geq 0.0$

Name:	*ccoef*
Relation:	**spvar**
Description:	Coefficient "c" of the quadratic trend of the log spectrum between frequencies *fmin* and *fmax*. The spectrum is measured in nm-sec.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Range:	Any floating point value

Name:	*cfreq*
Relation:	**detection, fkdisc**
Description:	The center frequency of a beam or f-k spectrum.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Hertz
Range:	$cfreq > 0.0$

Name:	*chan*
Relations:	**arrivalamp, detection, mag_coefs, originamp, refarea, refevent, sbsnr, siteaux**
Description:	Channel identifier. This is an eight-character code, which, taken together with *sta* and *time* uniquely identifies seismic time-series data, including the geographic location, spatial orientation, sensor and subsequent data processing (beam channel descriptor).
ORACLE:	VARCHAR(8)
NA Value:	An entry in the valid range is required.
Range:	Any string up to 8 characters

Name:	*chanid*
Relations:	**fsdisc**
Description:	Channel recording identifier. This is a surrogate key used to uniquely identify a specific recording. *chanid* duplicates the information of the compound key *sta*, *chan*, *time*.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*chanid* > 0

Name:	*class*
Relation:	**knowlobj**
Description:	Knowledge-object class. The knowledge-object class represents a segment of expert-system processing (e.g., initial wave type or station phase identification).
ORACLE:	VARCHAR(64)
NA Value:	- (a dash)
Range:	Any free-format string up to 64 characters

Name:	*code*
Relations:	**kbscause_xpl**
Description:	Unique identifier for the likely explanation for differences between an expert system location and an analyst location.
ORACLE:	VARCHAR(7)
NA Value:	An entry in the valid range is required.
Range:	Any free-format string up to 7 characters

Name:	*colormapid*
Relations:	**colordisc, mapcolor**
Description:	Colordisc identifier. Each colordisc is assigned a unique positive integer which identifies it in a database. The *colormapid* is used to identify color lookup tables available to maps.
ORACLE:	NUMBER(8)
Range:	*colormapid* > 0

Name:	*colormapname*
Relations:	**colordisc**
Description:	Colormap name. A name used to identify the color lookup table in a listing of available tables.
ORACLE:	VARCHAR(64)
NA Value:	An entry in the valid range is required.
Range:	Any string up to 64 characters

Name:	*colorname*
Relations:	**overlaydisc**
Description:	Name of color. Each overlay has a color associated with its graphical representation (e.g., "brown", "green", etc.).
ORACLE:	VARCHAR(32)
NA Value:	An entry in the valid range is required.
Range:	Any string up to 32 characters long which forms a color name

Name:	*commid*
Relations:	**apma, detection, fkdisc, fsdisc, netmag, refout, siteaux**
Description:	Comment identifier. This is a key used to point to free-form comments entered in the Version 3.0 core relation, **remark**. These comments store additional information about a tuple in another relation. Within the **remark** relation, there may be many tuples with the same *commid* and different *lineno*, but the same *commid* will appear in only one other tuple among the rest of the relations in the database (see *lineno*).
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*commid* > 0

Name:	*conf*
Relation:	**eventid**
Description:	Confidence measure for a particular event identification method.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Range:	$0.5 \leq conf \leq 1.0$

Name:	*dasta*
Relations:	**ex_an**
Description:	Difference in number of regional array stations contributing to the analyst and expert system origins. The value is [*asta* (analyst) - *asta* (expert system)] for analyst versus expert system comparisons or [*asta* (bulletin1) - *asta* (bulletin2)] for more general bulletin comparisons.
ORACLE:	NUMBER(8)
NA Value:	-999
Range:	*dasta* > -999

Name:	*datsw*
Relation:	**fkdisc, fsdisc**
Description:	A switch to indicate a data format data type. Proper values will be defined through the Center's software libraries and include files. A manual page will explain the meaning of *datsw* values and reference related software manual pages. It will be amended as new objects are defined.
ORACLE:	NUMBER(10)
NA Value:	An entry in the valid range is required.
Range:	*datsw* > 0

Name:	*ddepth*
Relation:	**bull_comp, ex_an**
Description:	Difference in depth between corresponding origin locations. For analyst versus expert system comparisons the value is [*depth* (analyst) - *depth* (expert system)]. For more general bulletin comparisons the value is [*depth* (bulletin1) - *depth* (bulletin2)].
ORACLE:	FLOAT(24)
NA Value:	-999.0
Units:	Kilometers
Range:	*ddepth* ≥ -999

Name:	*ddepthp*
Relation:	**ex_an**
Description:	Difference in the number of defining depth phases associated with analyst and expert system origins. A depth phase is a member of the set ("sP" "pP" "sS"). The value is [(number-analyst-phases) - (number-expert-phases)].
ORACLE:	NUMBER(8)
NA Value:	-999
Range:	*ddepthp* > -999

Name:	*ddist*
Relation:	**bull_comp, ex_an**
Description:	Difference in distance between corresponding origins in a bulletin comparison.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Kilometers
Range:	*ddist* ≥ 0.0

Name: *delamp*
Relation: **arrivalamp, originamp**
Description: Amplitude uncertainty.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Nanometers
Range: *delamp* > 1.0

Name: *delaz*
Relation: **detection**
Description: Azimuth uncertainty. It is an estimate of the standard deviation of the azimuth of a signal.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Degrees
Range: *delaz* > 0.0

Name: *delslo*
Relation: **detection**
Description: Slowness uncertainty. It is an estimate of the standard deviation of the slowness of a signal.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Seconds/kilometers (Note: These units are different from those of the *delslo* attribute in the Center Version 3.0 **arrival** relation.)
Range: *delslo* > 0.0

Name: *deltim*
Relation: **detection**
Description: Arrival time uncertainty. It is an estimate of the standard deviation of an arrival time.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Seconds
Range: *deltim* > 0.0

Name: *depthp*
Relations: **ev_summary**
Description: Number of time-defining depth phases. A depth phase is a member of the set ("sP", "pP", "sS").
ORACLE: NUMBER(8)
NA Value: -1
Range: *depthp* ≥ 0

Name:	*descr*
Relation:	**ampdescript, scriptloc**
Description:	Text description. Describes events used to generate the **script** in *scriptloc*. Describes amplitude measurement parameters in **ampdescript**.
ORACLE:	VARCHAR(255) in **ampdescript**, VARCHAR(20) in **scriptloc**
NA Value:	- (a dash)
Range:	Any free-format string up to field size

Name:	*descrip*
Relation:	**ref_loc**
Description:	Description of reference location.
ORACLE:	VARCHAR(80)
NA Value:	- (a dash)
Range:	Any free-format string up to 80 characters

Name:	*description*
Relation:	**kbscause_xpl, koparamdesc**
Description:	Explanation text describing the most likely reason an expert system and analyst reviewed event differ.
ORACLE:	VARCHAR(255)
NA Value:	- (a dash)
Range:	Any free-format string up to 255 characters

Name:	*dfile*
Relations:	**colordisc, fkdisc, fsdisc, mapdisc, overlaydisc**
Description:	Data file. In **fkdisc**, this is the filename of an f-k disk file. In **fsdisc**, this is the filename of a Fourier Spectrum disk file (see *dir*).
ORACLE:	VARCHAR(32)
NA Value:	An entry in the valid range is required.
Range:	Any string up to 32 characters that conforms to UNIX filename syntax

Name:	*did*
Relation:	**ex_an**
Description:	Difference in event type between the analyst and expert system origins (see *etype*). *did* is "y" if the event types are the same or "n" if the event types are different.
ORACLE:	VARCHAR(4)
NA Value:	- (a dash)
Range:	{y | n}, lower case

Name:	*dimx*
Relations:	**mapdisc**
Description:	The width (or x-dimension) of the Map in pixels.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*dimx* > 0

Name:	*dimy*
Relations:	**mapdisc**
Description:	The height (or y-dimention) of the Map in pixels.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*dimy* > 0

Name:	*dir*
Relations:	**colordisc, fkdisc, fsdisc, mapdisc, overlaydisc**
Description:	Directory. This attribute is the directory part of a path name. Relative path names or "." (dot), the notation for the current directory may be used.
ORACLE:	VARCHAR(64)
NA Value:	An entry in the valid range is required.
Range:	Any string up to 64 characters long that conforms to UNIX directory name syntax

Name:	*disorid*
Relation:	**disassoc, disorigin**
Description:	Dissolved origin identifier from expert-system processing. This event was dissolved based on the failure of some confirmation criteria.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*disorid* > 0

Name:	*dlat*
Relation:	**seisindex**
Description:	Latitude increment between grid cells in seisgrid.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Degrees
Range:	*dlat* ≥ 0.0

Name: *dlon*
Relation: **seisindex**
Description: Longitude increment between grid cells in seisgrid.
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Units: Degrees
Range: *dlon* ≥ 0.0

Name: *dlsta*
Relation: **ex_an**
Description: Difference in the number of local stations contributing to the corresponding bulletin origins. The value is [*lsta* (analyst) - *lsta* (expert system)] for analyst versus expert system comparisons, and [*lsta* (bulletin1) - *lsta* (bulletin2)] for more general bulletin comparisons.
ORACLE: NUMBER(8)
NA Value: -999
Range: *dlsta* > -999

Name: *dnarr*
Relation: **bull_comp, ev_summary**
Description: The absolute difference in the number of associated arrivals between corresponding origins.
ORACLE: NUMBER(8)
NA Value: -1
Range: *dnarr* ≥ 0

Name: *dndef*
Relation: **bull_comp, ex_an**
Description: Difference in the number of defining phases between corresponding origins. A phase is defining only if its time-component is defining. The value is [*ndef* (analyst) - *ndef* (expert system)] for analyst versus expert system comparisons, and [*ndef* (bulletin1) - *ndef* (bulletin2)] for more general bulletin comparisons.
ORACLE: NUMBER(8)
NA Value: -1
Range: *dndef* ≥ 0

Name:	*dnsta*
Relation:	**ex_an**
Description:	Difference in the number of contributing stations between the corresponding bulletin locations. The value is [*nsta* (analyst) - *nsta* (expert systems)] for analyst versus expert system comparisons, and [*nsta* (bulletin1) - *nsta* (bulletin2)] for more general bulletin comparisons.
ORACLE:	NUMBER(8)
NA Value:	-999
Range:	*dnsta* > -999

Name:	*dobjid*
Relation:	**kaudit**
Description:	Data-object identifier: the arid, orid, or stassid associated with the **kaudit** tuples.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*dobjid* > 0

Name:	*dobjtype*
Relation:	**kaudit**
Description:	Data-object type (arrival, stassoc, origin) of **kaudit** tuple.
ORACLE:	VARCHAR(2)
NA Value:	An entry in the valid range is required.
Range:	{A | O | S}

Name:	*dprimp*
Relation:	**ex_an**
Description:	Difference in the number of primary phases between corresponding origins. For a phase to be primary it must be time-defining, a member of the set ("P" "Pn" "Pg" "PKP" "PKPdf"), and the first arrival at a particular station. The value is [(number-analyst-phases) - (number-expert-phase)] for analyst versus expert-system comparisons and [(number-bulletin1-phases) - (number-bulletin2-phases)] for more general bulletin comparisons.
ORACLE:	NUMBER(8)
NA Value:	-999
Range:	*dprimp* > -999

Name: *drsta*
Relation: **ex_an**
Description: Difference in the number of regional non-array stations contributing to corresponding bulletin origins. The value is [*rsta* (analyst) - *rsta* (expert system)] for analyst versus expert-system comparisons or [*rsta* (bulletin1) - *rsta* (bulletin2)] for more general bulletin comparisons.
ORACLE: NUMBER(8)
NA Value: -999
Range: *drsta* > -999

Name: *dsecondp*
Relation: **ex_an**
Description: Difference in the number of secondary phases between corresponding bulletin origins. For a phase to be secondary it must be defining and cannot be a member of the phase set ("P" "Pn" "Pg" "PKP" "PKPdf"). The value is [(number-analyst-phases) - (number-expert-phases)] for analyst versus expert-system comparisons, and [(number-bulletin1-phases) - (number-bulletin2-phases)] for more general bulletin comparisons.
ORACLE: NUMBER(8)
NA Value: -999
Range: *dsecondp* > -999

Name: *dtime*
Relation: **bull_comp, ex_an**
Description: Difference in the origin time between corresponding origins. The value is [*time* (analyst) - *time* (expert system)] for analyst versus expert-system comparisons, and [(*time* (bulletin1) - *time* (bulletin2)] for more general bulletin comparisons.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Seconds
Range: (Any floating point value) *dtime* ≥ 0

Name: *dtsta*
Relation: **ex_an**
Description: Difference in the number of teleseismic stations (station/event distance > 2000 km) contributing to the analyst and expert system origins. The value is [*tsta* (analyst) - *tsta* (expert system)] for analyst versus expert-system comparisons, and [*tsta* (bulletin1) - *tsta* (bulletin2) for more general bulletin comparisons.
ORACLE: NUMBER(8)
NA Value: -999
Range: *dtsta* > -999

Name:	*end_time*
Relation:	**audit_admin, bull_comp_admin, summary_admin**
Description:	Ending time of comparison or processing.
ORACLE:	VARCHAR(30)
NA Value:	An entry in the valid range is required.
Range:	Any valid date

Name:	*eorid*
Relation:	**ex_an**
Description:	Expert system origin identifier in an expert system versus analyst origin comparison.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*eorid* > 0

Name:	*etype*
Relation:	**eventid, refevent**
Description:	Event type. Describes the type of seismic event as determined by the Event Identification System.
ORACLE:	VARCHAR(7)
NA Value:	- (a dash)
Range:	Possible values are "QUAKE", "BLAST", "EXPL", "IND"

Name:	*expert*
Relation:	**audit_admin, summary_admin**
Description:	Name of the Expert (KBS) database account.
ORACLE:	VARCHAR(50)
NA Value:	An entry in the valid range is required.
Range:	Any free-format string up to 50 characters

Name:	*expert1*
Relation:	**bull_comp_admin**
Description:	The user name of the first database account in the bulletin comparison.
ORACLE:	VARCHAR(50)
NA Value:	An entry in the valid range is required.
Range:	Valid account name

Name:	*expert2*
Relation:	**bull_comp_admin**
Description:	The user name of the second database account in the bulletin comparison.
ORACLE:	VARCHAR(50)
NA Value:	An entry in the valid range is required.
Range:	Valid account name

Name:	*explan*
Relation:	**knowlobj**
Description:	Explanation string that describes a particular knowledge object. This can contain references to either a constant name (**koconst**) or a variable name (**kovar**).
ORACLE:	LONG
NA Value:	- (a dash)
Range:	Any valid string up to 1,024 characters

Name:	*fchisq*
Relation:	**smatch**
Description:	Chi-squared percentage points, F [chi-squared]. This is set to zero if the value of a parameter is outside bounds specified in *amin* and *amax* (see **script**).
ORACLE:	FLOAT(24)
NA Value:	-1.0
Range:	$0 \leq fchisq \leq 1.0$

Name:	*fkid*
Relation:	**fkdisc**
Description:	Uniquely identifies a f-k spectrum file.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	$fkid > 0$

Name:	*fkqual*
Relation:	**detection**
Description:	An integer quantifying the quality of the f-k spectrum. An $fkqual = 1$ is high quality; an $fkqual = 4$ is low quality.
ORACLE:	NUMBER(4)
NA Value:	-1
Range:	$1 \leq fkqual \leq 4$

Name:	*fkrid*
Relation:	**fkdisc**
Description:	Uniquely defines a f-k spectrum recipe.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*fkrid* > 0

Name:	*fktyp*
Relation:	**fkdisc**
Description:	String to identify the type of f-k spectrum; examples are monochromatic ("mono") and broadband ("broa").
ORACLE:	An entry in the valid range is required.
Range:	Any lower case string up to 4 characters

Name:	*fmin*
Relation:	**spvar**
Description:	Minimum frequency of a band with *snr* > 3dB used for the spectral variance calculation.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Hertz
Range:	*0 < fmax < fmin*

Name:	*fmax*
Relation:	**spvar**
Description:	Maximum frequency of a band with *snr* > 3dB used for the spectral variance calculation.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Hertz
Range:	*fmax > fmin*

Name:	*foff*
Relation:	**fkdisc, fsdisc**
Description:	File offset; the byte offset of a data segment within a physical data file. It is non-zero if the data reference does not occur at the beginning of the file.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*foff* ≥ 0

Name: *forid*
Relation: **ex_an**
Description: Final origin identifier; the origin identification of the analyst *orid* in an expert system versus analyst origin comparison.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *forid* > 0

Name: *freq*
Relations: **apma**
Description: Center frequency of the wide-band polarization analysis. For example, if only the 2-4 Hz and 4-8 Hz bands satisfy the signal-to-noise ratio criterion, then *freq* is set to 5.0 Hz.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Hz
Range: *freq* > 0.0

Name: *fsid*
Relation: **fsdisc, spvar**
Description: Fourier spectrum identifier.
ORACLE: NUMBER(8)
NA Value: -1
Range: *fsid* > 0

Name: *fsrid*
Relation: **fsdisc**
Description: Fourier spectrum recipe identifier.
ORACLE: NUMBER(8)
NA Value: -1
Range: *fsrid* > 0

Name: *fstat*
Relation: **detection**
Description: F-statistic; a measure of the signal-to-noise ratio at the peak in the f-k spectrum.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: *fstat* ≥ 0

Name: *fstyp*
Relation: **fsdisc**
Description: String specifying the type of Fourier spectrum, e.g., amplitude ("ampl"), phase ("phas"), complex ("comp"), and power ("powe").
ORACLE: VARCHAR(4)
NA Value: An entry in the valid range is required.
Range: Any lower case string up to 4 characters

Name: *grdname*
Relation: **seisgrid, seisindex**
Description: Name for identifying the basis of a natural seismicity grid.
ORACLE: VARCHAR(6)
NA Value: An entry in the valid range is required.
Range: Any free-format string up to field size

Name: *grn*
Relations: **ev_summary**
Description: Geographic region number, as defined by Flinn, Engdahl and Hill (Bull. Seism. Soc. Amer. vol 64, pp. 771-992, 1974).
ORACLE: NUMBER(8)
NA Value: -1
Range: *grn* > 0

Name: *gvhi*
Relations: **ampdescript**
Description: High group velocity for determining a time window. It defines the start time of an amplitude measurement window if *toff* is null. If *gvhi* is used, then *gvlo* must be used to define the end time of the window.
ORACLE: FLOAT (24)
NA Value: -999.0
Units: km/sec
Range: *gvhi* > *gvlo*

Name: *gvlo*
Relations: **ampdescript**
Description: Low group velocity for determining a time window. It defines the end time of an amplitude measurement window if *tlen* is null or if *gvhi* is used to define the start time of the window.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: km/sec
Range: *gvlo* > 0

Name: *hfcorner*
Relations: **refarea**
Description: High-frequency corner used when data are to be filtered.
ORACLE: NUMBER(8)
NA Value: - (a dash)
Units: Hz
Range: $0 \leq$ *hfcorner* $\leq$ sample rate/2

Name: *hmxmn*
Relations: **apma**
Description: Maximum-to-minimum horizontal amplitude ratio defined as: $(\lambda_1/\lambda_2)^{1/2}$ where λ_1 and λ_2 are the maximum and minimum eigenvalues obtained by solving the 2-D eigensystem using only the horizontal components. This is an S-type attribute calculated at the time of maximum 3-component amplitude.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: *hmxmn* ≥ 0.0

Name: *hvrat*
Relations: **apma**
Description: Horizontal-to-vertical power ratio defined as: $\frac{c_3 + c_2}{2c_1}$ where c_1, c_2, and c_3 are the diagonal elements of the covariance matrix (c_1 corresponds to the vertical component). This is an S-type attribute calculated at the time of the maximum 3-component amplitude.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: *hvrat* ≥ 0.0

Name: *hvratp*
Relations: **apma**
Description: Horizontal-to-vertical power ratio defined as: $\frac{c_3 + c_2}{2c_1}$ where c_1, c_2, and c_3 are the diagonal elements of the covariance matrix (c_1 corresponds to the vertical component). This is a P-type attribute calculated at the time of maximum rectilinearity.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: *hvratp* ≥ 0.0

Name: *icell*
Relations: **seisgrid**
Description: Grid cell index. For example, the latitude and longitude of cell number *icell* are computed as follows if *orderby* = *lat*:

$$lat\,(icell) = lat1 + int\frac{(icell-1)}{nlon} \times dlat$$

$$lon\,(icell) = lon1 + mod\frac{(icell-1)}{nlon} \times dlon$$

ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *icell* > 0

Name: *inang1*
Relations: **apma**
Description: Apparent incidence angle (measured from the vertical) of the eigenvector (e_1) associated with the largest eigenvalue (λ_1). It is also called the long-axis incidence angle, or the emergence angle. It is a P-type attribute calculated at the time of maximum rectilinearity.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Degrees
Range: $0.0 \leq inang1 < 90.0$

Name: *inang3*
Relations: **apma**
Description: Apparent incidence angle (measured from the vertical) of the eigenvector (e_3) associated with the smallest eigenvalue (λ_3). It is also called the short-axis incidence angle. It is an S-type attribute measured at the time of the maximum 3-component amplitude.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Degrees
Range: $0.0 \leq inang3 < 90.0$

Name: *inarrival*
Relations: **arrivalamp**
Description: Flag to indicate if *amp* is the same as it is in the **arrival** table.
ORACLE: NUMBER(2)
NA Value: -1
Range: $inarrival \subset [0, 1]$

Name:	*jdate*
Relations:	**detection, fkdisc, fsdisc**
Description:	Julian date; date of an arrival, origin, seismic recording, etc. The same information is available in epoch time, but the Julian date format is more convenient for many types of searches. Dates B.C. are negative. There is no year = 0000 or day = 000. Where only the year is known, day of year = 001; where only year and month are known, day of year = first day of month. Only the year is negated for B.C., so January 1 of 10 B.C. is -0010001 (see *time*).
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	Julian dates are of the form yyyyddd; must be consistent with the accompanying *time* attribute

Name:	*kbscause*
Relation:	**ex_an**
Description:	Code corresponding to an explanation of a likely cause of an error in the expert system solution. Code descriptions are in the table **kbscause_xpl**.
ORACLE:	VARCHAR(7)
NA Value:	- (a dash)
Range:	Any free format string up to 7 characters

Name:	*koid*
Relation:	**disorigin, kaudit, knowlobj, koconst**
Description:	Knowledge-object index. Each knowledge object is assigned a unique, positive integer. The knowledge-object (stored in the **knowlobj** relation) is referenced by other relations by its *koid*.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*koid* > 0

Name:	*label*
Relations:	**mapdisc**
Description:	Header for Map listing. A label, such as "world", categorizes each Map. *label* is used to build a sorted list of maps in the Map program.
ORACLE:	VARCHAR(65)
NA Value:	- (a dash)
Range:	Any string up to 65 characters long

Name: *lat*
Relations: **mappoint, mine, refevent, ref_loc, scriptloc**
Description: Geographic latitude. Locations north of the equator have positive latitudes.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Degrees
Range: $-90.0 \leq lat \leq 90.0$

Name: *lat1*
Relations: **seisindex**
Description: Southern-most latitude of the first grid cell in seisgrid.
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Units: Degrees
Range: $-90.0 \leq lat1 \leq +90.0$

Name: *latmajor*
Relations: **mapdisc**
Description: Latitude interval (in degrees) for displaying major grid lines on the Map.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: $0 < latmajor < 90.0$

Name: *latminor*
Relations: **mapdisc**
Description: Latitude interval (in degrees) for displaying minor grid lines on the Map.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: $0 < latminor < 90.0$

Name: *latorigradians*
Relations: **mapdisc**
Description: Latitude origin radians. Coordinates in radians of the lower left corner of the Map. The Map uses this for mercator projections only.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: $\frac{-\pi}{2} < latorigradians < \frac{\pi}{2}$

Name:	*lddate*
Relations:	**ampdescript, apma, arrivalamp, audit_admin, bull_comp, bull_comp_admin, ceppks, colordisc, detection, disassoc, disorigin, eventid, ev_summary, ex_an, fkdisc, fsdisc, kaudit, knowlobj, koconst, koparamdesc, kovar, mag_coefs, mapcolor, mapdisc, mapover, mappoint, mine, originamp, overlaydisc, perfV_arid_mappings, refarea, refevent, ref_loc, refout, sbsnr, script, scriptloc, seisgrid, seisindex, siteaux, smatch, smatchvar, spvar, summary_admin, timestamp**
Description:	Load date. The date and time the record was inserted into the database. For the **bull_comp** relation, it is the date of the comparison.
ORACLE:	DATE
NA Value:	An entry in the valid range is required.
Range:	Any valid date

Name:	*lfcorner*
Relations:	**refarea**
Description:	Low-frequency corner used when data are to be filtered.
ORACLE:	NUMBER(8)
NA Value:	- (a dash)
Units:	Hz
Range:	$0 \leq$ *lfcorner* $\leq$ sample rate/2

Name:	*lon*
Relations:	**mappoint, mine, refevent, ref_loc, scriptloc**
Description:	Geographic longitude. Longitudes are measured positive east of the Greenwich meridian.
ORACLE:	FLOAT(24)
NA Value:	-999.0
Units:	Degrees
Range:	$-180.0 \leq$ *lon* ≤ 180.0

Name:	*lon1*
Relations:	**seisindex**
Description:	Western-most longitude of the first grid cell in **seisgrid**.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Degrees
Range:	$-180.0 \leq$ *lon*1 ≤ 180.0

Name: *lonmajor*
Relations: **mapdisc**
Description: Longitude interval (in degrees) for displaying major grid lines on the Map.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: $0 < lonmajor < 180.0$

Name: *lonminor*
Relations: **mapdisc**
Description: Longitude interval (in degrees) for displaying minor grid lines on the Map.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: $-180.0 < lonminor < 180.0$

Name: *lonorigradians*
Relations: **mapdisc**
Description: Longitude origin radians. Coordinates in radians of the lower left corner of the Map. The Map uses this for mercator projections only.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: $-\pi \leq latorigradians \leq \pi$

Name: *lsta*
Relation: **ev_summary**
Description: Number of local arrival times associated with an event. "Local" is currently defined as a station-event distance of less than 250 km.
ORACLE: NUMBER(8)
NA Value: -1
Range: $lsta > 0$

Name: *ltav*
Relation: **sbsnr**
Description: Long-term average at the detection time. It is used to define the amplitude of the noise. The amplitude is averaged over a window length which is defined in SigPro processing.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Nanometers
Range: $ltav > 0.0$

Name:	*magth*
Relation:	**seisgrid**
Description:	Magnitude threshold used to calculate the number of events per year in each grid cell.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Range:	Any valid magnitude value is allowed

Name:	*magtype*
Relation:	**seisgrid**
Description:	Magnitude type, e.g., "mb" (see Version 3.0 core descriptions).
ORACLE:	VARCHAR(6)
NA Value:	An entry in the valid range is required.
Range:	Any free-format string up to 6 characters long

Name:	*mapfiletype*
Relations:	**mapdisc**
Description:	Specifies how the Map program handles the referenced Map file. If *mapfiletype* = "all" then the program reads the file in its entirety. If *mapfiletype* = blk, then the program reads only the blocks necessary for the display area.
ORACLE:	VARCHAR(4)
NA Value:	An entry in the valid range is required.
Range:	{all | blk}, lower case

Name:	*mapid*
Relations:	**mapcolor, mapdisc, mapover**
Description:	**Mapdisc** identifier. Each **mapdisc** is assigned a unique positive integer which identifies it in a database.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*mapid* > 0

Name:	*mapname*
Relations:	**mapdisc**
Description:	Name of the Map. Each Map is assigned a name for identifying the Map in a list of all maps.
ORACLE:	VARCHAR(64)
NA Value:	An entry in the valid range is required.
Range:	Any string up to 64 characters long

Name: *maptype*
Relations: **mapdisc**
Description: Type of Map. A positive integer enumerator for identifying the output graphic type, either raster or vector (*maptype* = 1 for raster and *maptype* = 2 for vector).
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: 1 or 2

Name: *maxf*
Relation: **fsdisc**
Description: Maximum frequency. Frequency of the last sample in a Fourier spectrum.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Hertz
Range: *maxf* > 0.0

Name: *maxkx*
Relation: **fkdisc**
Description: Maximum wavenumber along x-axis in an f-k spectrum. F-k spectra are assumed to be symmetrical, ranging from -*maxkx* to *maxkx*.
ORACLE: FLOAT(24)
NA Value: -1.0 (Either *maxkx* or *maxsx* must be set.)
Units: Inverse kilometers
Range: *maxkx* > 0.0

Name: *maxky*
Relation: **fkdisc**
Description: Maximum wavenumber along y-axis of an f-k spectrum. F-k spectra are assumed to be symmetrical, ranging from -*maxky* to *maxky*.
ORACLE: FLOAT(24)
NA Value: -1.0 (Either *maxky* or *maxsy* must be set.)
Units: Inverse kilometers
Range: *maxky* > 0.0

Name:	*maxlat*
Relation:	**refarea**
Description:	Maximum latitude defining a reference area. Locations north of the equator have positive latitude.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Degrees
Range:	-90.0 ≤ *maxlat* ≤ 90.0

Name:	*maxlon*
Relation:	**refarea**
Description:	Maximum longitude defining a reference area. Locations east of the Greenwich Meridian have positive longitude.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Degrees
Range:	-180.0 ≤ *maxlon* ≤ 180.0

Name:	*maxsx*
Relation:	**fkdisc**
Description:	Maximum slowness along the x-axis in a broadband f-k spectrum. F-k spectra are assumed to be symmetrical, ranging from *-maxsx* to *maxsx*.
ORACLE:	FLOAT(24)
NA Value:	-1.0 (Either *maxkx* or *maxsx* must be set.)
Units:	Seconds/kilometers
Range:	*maxsx* > 0.0

Name:	*maxsy*
Relation:	**fkdisc**
Description:	Maximum slowness along the y-axis in a broadband f-k spectrum. f-k spectra are assumed to be symmetrical, ranging from *-maxsy* to *maxsy*.
ORACLE:	FLOAT(24)
NA Value:	-1.0 (Either *maxsy* or *maxky* must be set.)
Units:	Seconds/kilometers
Range:	*maxsy* > 0.0

::	*mcode*
ions:	**eventid, mine, scriptloc**
ription:	Mine code.
CLE:	VARCHAR(6)
/alue:	- (a dash) if the relation is not for a mine site or blast
ge:	Free-format string up to 6 characters

me:	*method*
ation:	**eventid**
scription:	Method used to identify event. It may be either the combined result of individual methods (i.e., "COMPOSITE") or any of the individual methods (e.g., "SPVAR") used in event identification.
CACLE:	VARCHAR(15)
(A Value:	- (a dash)
Range:	Free-format string up to 15 characters

Name:	*minid*
Relation:	**minex** (This table is from the ground-truth database at CSS, Grant *et al.* [1993].), **refevent**
Description:	Mine identifier if the reference event is associated with a mine.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*minid* ≥ 1

Name:	*minlat*
Relation:	**refarea**
Description:	Minimum latitude defining a reference area. Locations north of the equator have positive latitude.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Degrees
Range:	-90.0 ≤ *minlat* ≤ 90.0

Name:	*minlon*
Relation:	**refarea**
Description:	Minimum longitude defining a reference area. Locations east of the Greenwich Meridian have positive longitude.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Units:	Degrees
Range:	-180.0 ≤ *minlon* ≤ 180.0

Name:	*mname*
Relations:	**mine**
Description:	Descriptive mine name corresponding to *mcode*.
ORACLE:	VARCHAR(15)
NA Value:	- (a dash)
Range:	Any free-format string up to 15 characters

name:	*mpdescrip*
Relations:	**mappoint**
Description:	Arbitrary string describing the referenced geographic point.
ORACLE:	VARCHAR(50)
NA Value:	- (a dash)
Range:	Any free-format string up to 50 characters.

name:	*mplabel*
Relations:	**mappoint**
Description:	This string is used as a label for the geographic point described by a tuple in the **mappoint** relation (e.g., "Paris", "London", "K8", etc.).
ORACLE:	VARCHAR(65)
NA Value:	- (a dash)
Range:	Any free-format string up to 65 characters

name:	*mptype*
Relations:	**mappoint**
Description:	This string specifies the type of geographic point described by a tuple in the **mappoint** relation. Examples include "cities", "mines", "noress mines", etc.
ORACLE:	VARCHAR(20)
NA Value:	- (a dash)
Range:	Any free-format string up to 20 characters

Name:	*mtype*
Relations:	**ampdescript**
Description:	Measurement type. This attribute defines how the amplitude is measured in a given time window. The following values are allowed: "peak" (maximum amplitude), "stav" (maximum short-term average amplitude), "rms" (root-mean squared amplitude), "peak2tr" (maximum peak-to-trough amplitude), and "1stpeak" (first motion amplitude).
ORACLE:	VARCHAR(8)
NA Value:	- (a dash)
Range:	["peak", "stav", "rms", "peak2tr", "1stpeak"]

Name:	*multev*
Relation:	**ev_summary, ex_an**
Description:	Indicates whether or not there is another analyst event solution within 50 km and 5 minutes of the analyst event (i.e., multiple event).
ORACLE:	VARCHAR(4)
NA Value:	- (a dash)
Range:	{y | n}, lower case

Name:	*mval*
Relation:	**smatchvar**
Description:	Measured value of the attribute.
ORACLE:	FLOAT(24)
NA Value:	-999.0
Range:	*mval* > -999.0

Name:	*name*
Relation:	**knowlobj, koconst, kovar, koparamdesc**
Description:	Name of a constant, variable or parameter.
ORACLE:	VARCHAR(64)
NA Value:	- (a dash)

Name:	*narr1*
Relation:	**bull_comp**
Description:	The number of associated arrivals for *orid1*.
ORACLE:	NUMBER(8)
NA Value:	- 1
Range:	*narr1* ≥ 0

Name:	*narr2*
Relation:	**bull_comp**
Description:	The number of associated arrivals for *orid2*.
ORACLE:	NUMBER(8)
NA Value:	- 1
Range:	*narr2* ≥ 0

Name: *ndef*
Relation: **ev_summary**
Description: Number of time-defining phases.
ORACLE: NUMBER(8)
NA Value: -1
Range: $0 < ndef \leq nass$

Name: *ndef1*
Relation: **bull_comp**
Description: Number of time-defining phases for *orid1*.
ORACLE: NUMBER(8)
NA Value: -1
Range: $ndef1 \geq 0$

Name: *ndef1arr2*
Relation: **bull_comp**
Description: Number of defining arrivals for *orid1* that are arrivals (defining or non-defining) for *orid2*.
ORACLE: NUMBER(8)
NA Value: -1
Range: $ndef1arr2 \geq 0$

Name: *ndef2*
Relation: **bull_comp**
Description: Number of time-defining phases for *orid2*.
ORACLE: NUMBER(8)
NA Value: -1
Range: $ndef2 \geq 0$

Name: *ndef2arr1*
Relation: **bull_comp**
Description: Number of defining arrivals for *orid2* that are arrivals (defining or non-defining) for *orid1*.
ORACLE: NUMBER(8)
NA Value: -1
Range: $ndef2arr1 \geq 0$

Name: *ndegf*
Relation: **smatch**
Description: Number of degrees of freedom used in the chi-squared test. This is set to zero if the value of a parameter was outside bounds specified in *amin* and *amax* (see **script**).
ORACLE: NUMBER(8)
NA Value: 0
Range: *ndegf* > 0

Name: *nearaz*
Relation: **ev_summary**
Description: Azimuth from nearest station to the event.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Degrees
Range: 0 ≤ *nearaz* < 360.0

Name: *neardist*
Relation: **ev_summary**
Description: Distance from the event to the closest station.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Kilometers
Range: *neardist* > 0.0

Name: *nearsta*
Relation: **ev_summary**
Description: Code for the nearest station to the event.
ORACLE: VARCHAR(6)
NA Value: - (a dash)
Range: Any valid station code

Name: *nevyr*
Relation: **seisgrid**
Description: Average number of events per year with magnitude above *magth* whose location is within the grid cell defined by *icell*.
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Range: *nevyr* ≥ 0

Name: *nf*
Relation: **fsdisc**
Description: Number of frequency values in the spectrum file.
ORACLE: NUMBER(4)
NA Value: An entry in the valid range is required.
Range: $nf > 0$

Name: *nlat*
Relation: **seisindex**
Description: Number of latitudes in seisgrid.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: $nlat > 0.0$

Name: *nlon*
Relation: **seisindex**
Description: Number of longitudes in seisgrid.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: $nlon > 0.0$

Name: *nmatch*
Relation: **bull_comp**
Description: Number of matching arrivals (defining or non-defining) between *orid1* and *orid2*.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: $nmatch \geq 0$

Name: *nmorid*
Relation: **bull_comp_admin**
Description: Number of matching orids between bulletin1 and bulletin2 which are strongly associated (*asstr* = "s").
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: $nmorid \geq 0$

Name: *nmoridw*
Relation: **bull_comp_admin**
Description: Number of matching orids between *bulletin1* and *bulletin2* which are weakly associated (*asstr* = "w").
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *nmoridw* ≥ 0

Name: *nois*
Relation: **siteaux**
Description: Nominal background noise level.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Nanometers
Range: *nois* ≥ 0.0

Name: *noissd*
Relation: **siteaux**
Description: Standard deviation of the log noise amplitude.
ORACLE: FLOAT(24)
NA Value: -999.0
Range: *noissd* > 0

Name: *norid1*
Relation: **bull_comp_admin**
Description: Number of orids in the bulletin1 database within the time interval of the bulletins being compared.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *norid1* ≥ 0

Name: *norid2*
Relation: **bull_comp_admin**
Description: Number of orids in the bulletin2 database within the time interval of the bulletins being compared.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *norid2* ≥ 0

Name: *nphase*
Relation: **smatch**
Description: Number of phases used in the script match.
ORACLE: NUMBER(8)
NA Value: -1
Range: *nphase* ≥ 0

Name: *nsta*
Relation: **ev_summary, netmag, smatch**
Description: Number of stations. In **ev_summary** it is the number of stations with an associated arrival. In **smatch** it is the number of stations used in the script match. In **netmag** it is the number of stations contributing to the network magnitude estimate.
ORACLE: NUMBER(8)
NA Value: -1
Range: *nsta* > 0

Name: *nwindow*
Relation: **refarea**
Description: Number of windows used in cross-correlation computation.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *nwindow* ≥ 1

Name: *nx*
Relation: **fkdisc**
Description: The total number of X sample points (either slowness or wavenumber, depending on *fktyp*) in a f-k spectrum.
ORACLE: NUMBER(4)
NA Value: An entry in the valid range is required.
Range: *nx* > 0

Name: *ny*
Relation: **fkdisc**
Description: The total number of Y sample points (either slowness or wavenumber, depending on *fktyp*) in a f-k spectrum.
ORACLE: NUMBER(4)
NA Value: An entry in the valid range is required.
Range: *ny* > 0

Name:	*orderby*
Relation:	**seisindex**
Description:	Grid order. The seismic grid can either be ordered by *lat* or ordered by *lon*.
ORACLE:	VARCHAR(6)
NA Value:	An entry in the valid range is required.
Range:	*lat* or *lon*

Name:	*orid*
Relations:	**ceppks, disorigin, eventid, ev_summary, netmag, originamp, refout, smatch, smatchvar**
Description:	Origin identifier which relates a tuple in these tables to a tuple in an **origin** table. In the **disorigin** relation, it is the analyst orid corresponding to a dissolved expert system event.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required. For **disorigin**, NA value = -1
Range:	*orid* > 0

Name:	*orid1*
Relation:	**bull_comp**
Description:	The origin identifier from the *bulletin1* database **origin** table.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*orid1* > 0

Name:	*orid2*
Relation:	**bull_comp**
Description:	The origin identifier from the *bulletin2* database **origin** table.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*orid2* > 0

Name:	*overlayid*
Relations:	**mapover, overlaydisc**
Description:	**overlaydisc** identifier. Each **overlaydisc** is assigned a unique positive integer which identifies it in a database. The *overlayid* is used to identify the overlays available to maps.
ORACLE:	NUMBER(8)
NA Value:	An entry in the valid range is required.
Range:	*overlayid* > 0

Name:	*overlayname*
Relations:	**overlaydisc**
Description:	Overlay name. A name used to identify the overlay in a listing of available overlays.
ORACLE:	VARCHAR (64)
NA Value:	An entry in the valid range is required.
Range:	Any string up to 64 characters long

Name:	*params*
Relation:	**refarea**
Description:	List of other parameters used in processing data for mine characterization.
ORACLE:	VARCHAR(80)
NA Value:	- (a dash)
Range:	Any free-format string up to field size

Name:	*per*
Relation:	**arrivalamp, originamp**
Description:	Measured period at the time of the amplitude measurement.
ORACLE:	FLOAT(24)
NA Value:	-999.0
Units:	Seconds
Range:	*per* > 0.0

Name:	*phase*
Relations:	**apma, mag_coefs, originamp, refevent, script, smatchvar**
Description:	Phase type. The identity of a seismic phase which has been associated to an arrival. Standard seismological labels for phases are used (e.g., P, PKP, PcP, pP, etc.). Both upper and lower case letters are available and should be used when appropriate, for example, pP or PcP.
ORACLE:	VARCHAR (8)
NA Value:	- (a dash) if this attribute does not apply to seismic phases
Range:	Any string up to 8 characters that conforms to seismological practice

Name:	*pkqf*
Relations:	**ceppks**
Description:	Quefrency of consistent cepstral peak. This is set to zero if there are no consistent peaks.
ORACLE:	FLOAT(24)
NA Value:	0.0
Units:	Seconds
Range:	*pkqf* > 0.0

Name: *pkamp*
Relations: **ceppks**
Description: Amplitude of consistent cepstral peak. This is set to zero if there are no consistent peaks. The spectrum is measured in nm-sec.
ORACLE: FLOAT(24)
NA Value: 0.0
Range: $pkamp > 0.0$

Name: *planlr*
Relations: **apma**
Description: Planarity is an S-type polarization attribute defined as $1 - \frac{\lambda_3}{\lambda_2}$ where λ_2 and λ_3 are eigenvalues from the decomposition of the covariance matrix. It is measured at the time of maximum 3-component amplitude.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $0.0 \leq planlr \leq 1.0$

Name: *plans*
Relations: **apma**
Description: Planarity is an S-type polarization attribute defined as $1 - \frac{\lambda_3}{\lambda_2}$ where λ_2 and λ_3 are eigenvalues from the decomposition of the covariance matrix. It is measured at the time of maximum 3-component amplitude. The only difference between *plans* and *planlr* is in the definition of the overlapping time windows.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $0.0 \leq plans \leq 1.0$

Name: *primp*
Relation: **ev_summary**
Description: Number of primary time-defining phases. A primary phase is defined as the first phase for a given station belonging to the set (P, Pn, Pg, PKP, PKPdf).
ORACLE: NUMBER(8)
NA Value: -1
Range: $primp \geq 0$

Name: *procclass*
Relation: **timestamp**
Description: Process class, used to group processes.
ORACLE: VARCHAR(16)
NA Value: An entry in the valid range is required.
Range: Any upper case string up to 16 characters

Name: *procname*
Relation: **timestamp**
Description: Process name which identifies a process in a process class.
ORACLE: VARCHAR(16)
NA Value: An entry in the valid range is required.
Range: Any upper case string up to 16 characters

Name: *proctime*
Relation: **timestamp**
Description: Last epoch time processed.
ORACLE: FLOAT(53)
NA Value: -9999999999.999
Units: Seconds since midnight January 1, 1970

Name: *projection*
Relations: **mapdisc**
Description: Projection of the Map; a positive integer enumerator for uniquely classifying the stereographic projection of the Map. Azimuthal equidistant = 2; Mercator = 3.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: 2 or 3

Name: *ptime*
Relations: **apma**
Description: Epoch time at which P-type polarization attributes are estimated. This is the center of the time window with maximum rectilinearity.
ORACLE: FLOAT(53)
NA Value: -9999999999.999
Units: Seconds since midnight January 1, 1970.

Name: *ptmcor*
Relation: **siteaux**
Description: P-wave arrival time correction.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Seconds
Range: Any floating point value

Name: *ptyp*
Relation: **ceppks**
Description: Consistent cepstral peak type. This is FC-PHS if consistent Fourier cepstral peaks are found across two or more phases for one array and there is no peak in the noise cepstrum at this quefrency. Otherwise, it is "-" if no consistent cepstral peaks are found.
ORACLE: VARCHAR(6)
NA Value: - (a dash)
Range: "FC-PHS" or "-"

Name: *raid*
Relation: **refarea, refevent**
Description: Identifier for a reference area. This reference area is defined geographically by *minlat*, *maxlat*, *minlon*, *maxlon*.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: $raid \geq 1$

Name: *rdepthp*
Relation: **ex_an**
Description: The number of depth phases renamed by the analyst (see *ddepthp* for definition of depth phase).
ORACLE: NUMBER(8)
NA Value: -999
Range: $rdepthp > 0$

Name: *rect*
Relation: **apma**
Description: Signal rectilinearity defined as: $1 - \frac{\lambda_3 + \lambda_2}{2\lambda_1}$ where λ_1, λ_2, and λ_3 are the three eigenvalues from the decomposition of the covariance matrix. This is the maximum rectilinearity for all overlapping time windows.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $0.0 \leq rect \leq 1.0$

Name:	*refaz*
Relation:	**ev_summary**
Description:	Azimuth to nearest reference point (reference locations are stored in the **ref_loc** relation).
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Degrees
Range:	$0.0 \leq refaz < 360.0$

Name:	*refdist*
Relation:	**ev_summary**
Description:	Distance to nearest reference point (reference locations are stored in the **ref_loc** relation).
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Kilometers
Range:	$refdist \geq 0.0$

Name:	*refid*
Relation:	**ev_summary, ref_loc**
Description:	Reference location identifier.
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	$refid > 0$

Name:	*reflat*
Relations:	**mapdisc**
Description:	Latitude reference; latitude of the center of the Map's projection (used for azimuthal equidistant projections only).
ORACLE:	FLOAT(24)
NA Value:	-999.0
Units:	Degrees
Range:	$-90.0 \leq reflat \leq 90.0$

Name: *reflon*
Relations: **mapdisc**
Description: Longitude reference; longitude of the center of the Map's projection (used for azimuthal equidistant projections only).
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Degrees
Range: $-180.0 \leq reflon \leq 180.0$

Name: *refname*
Relation: **refarea, ref_loc**
Description: Reference location name in **ref_loc**. Common geographic reference area name in **refarea**.
ORACLE: VARCHAR(16)
NA Value: An entry in the valid range is required in **ref_loc**; - (a dash) in **refarea**.
Range: Any upper case string up to 16 characters

Name: *refoffsetlat*
Relations: **mapdisc**
Description: Latitude offset reference. This is the reference (in pixels) from the lower left corner of the Map to the center of the Map's projection. In the case where the reference point is at the center of the Map, the offsets are equal to half the Map width and height. For azimuthal equidistant projections only.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $refoffsetlat > 0$

Name: *refoffsetlon*
Relations: **mapdisc**
Description: Longitude offset reference. This is the reference (in pixels) from the lower left corner of the Map to the center of the Map's projection. For azimuthal equidistant projections only.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $refoffsetlon > 0$

Name: *reid*
Relation: **refevent, refout**
Description: Reference event identifier.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: $reid \geq 1$

Name: *rely*
Relation: **siteaux**
Description: The station reliability. It is an estimate of the percentage of time the station is up.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $0.0 \leq rely \leq 1.0$

Name: *retime*
Relation: **ex_an**
Description: Number of phases retimed by an analyst.
ORACLE: NUMBER(8)
NA Value: -1
Range: $retime \geq 0$

Name: *rotation*
Relations: **mapdisc**
Description: Map rotation. This is the rotation of the projection from 0°, or due north. Rotation specifies the azimuth of the y-raster in degrees clockwise from north (for azimuthal equidistant projections only).
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Degrees
Range: $0 \leq rotation < 360.0$

Name: *rprimp*
Relation: **ex_an**
Description: The number of primary phases renamed by the analyst (see *dprimp* for definition of primary phase).
ORACLE: NUMBER(8)
NA Value: -1
Range: $rprimp \geq 0$

Name: *rsecondp*
Relation: **ex_an**
Description: The number of secondary phases renamed by the analyst (see *dsecondp* for definition of secondary phase).
ORACLE: NUMBER(8)
NA Value: -1
Range: $rsecondp \geq 0$

Name: *rsta*
Relation: **ev_summary**
Description: Number of non-array regional arrival times. "Regional" is defined as a station-event distance not less than 250 km and up to 2000 km.
ORACLE: NUMBER(8)
NA Value: -1
Range: *rsta* ≥ 0

Name: *saar*
Relations: **refarea**
Description: Signal length after the first arrival to be processed. This value should not exceed the length of the waveform available in the **wfdisc** relation and is determined by *end_time* - arrival time.
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Units: Seconds
Range: *saar* ≥ 0

Name: *sbar*
Relations: **refarea**
Description: Signal length before the first arrival to be processed. This value should not exceed the length of the waveform available in the **wfdisc** relation and is determined by arrival time - *time* (start time of waveform).
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Units: Seconds
Range: *sbar* ≥ 0

Name: *scale*
Relations: **mapdisc**
Description: Map scale.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Radians per pixel for mercator projections; kilometers per pixel for azimuthal equidistant projections
Range: *scale* > 0

Name: *scid*
Relations: **script, scriptloc, smatch, smatchvar**
Description: Script identifier.
ORACLE: NUMBER(8)
NA Value: An entry in the valid range is required.
Range: *scid* > 0

Name: *sconf*
Relations: **smatchvar**
Description: Script confidence equal to *fchisq* if this attribute is used in the chi-squared test. If attribute is specified by a minimum and maximum value, *sconf* is NA.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: $0.0 \leq sconf \leq 1.0$

Name: *sd*
Relation: **mag_coefs**
Description: Standard deviation of log amplitude.
ORACLE: FLOAT(24)
NA Value: -1.0
Range: *sd* > 0.0

Name: *seaz*
Relation: **detection**
Description: Station-to-event azimuth calculated from the station and event locations and measured clockwise from north.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Degrees
Range: $0.0 \leq seaz \leq 360.0$

Name: *seazlr*
Relation: **apma**
Description: Azimuth of the eigenvector (e_3) associated with the smallest eigenvalue (λ_3). It is corrected by 180° to give an estimate of the station-to-event azimuth (with an 180° ambiguity). It is an S-type attribute calculated at the time of the maximum 3-component amplitude. The only difference between *seazs* and *seazlr* is in the definition of the overlapping time windows.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Degrees
Range: $0.0 \leq seazlr \leq 360.0$

Name: *seazp*
Relation: **apma**
Description: Azimuth of the eigenvector (e_1) associated with the largest eigenvalue ($\lambda 1$). It is corrected by 180° to give an estimate of the station-to-event azimuth. It is a P-type attribute calculated at the time of maximum rectilinearity.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Degrees
Range: $0.0 \leq seazp \leq 360.0$

Name: *seazs*
Relation: **apma**
Description: Azimuth of the eigenvector (e_3) associated with the smallest eigenvalue (λ_3). It is corrected by 180° to give an estimate of the station-to-event azimuth (with an 180° ambiguity). It is an S-type attribute calculated at the time of the maximum 3-component amplitude. The only difference between *seazs* and *seazlr* is in the definition of the overlapping time windows.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Degrees
Range: $0.0 \leq seazs \leq 360.0$

Name: *secondp*
Relation: **ev_summary**
Description: Number of time-defining secondary phases. A secondary phase is any phase not in the set (P, Pn, Ps, PkP, PKPdf).
ORACLE: NUMBER(8)
NA Value: -1
Range: $secondp \geq 0$

Name:	*slow*
Relation:	**detection**
Description:	The observed slowness of a detected arrival.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Seconds/kilometers (NOTE: these units are different from those of the *slow* attribute in the Center Version 3.0 **arrival** relation.)
Range:	*slow* ≥ 0.0

Name:	*slodef*
Relation:	**disassoc**
Description:	Slowness defining code. This one-character flag indicates whether or not the slowness was used to constrain the event location. It is defining (*slodef* = d) or non-defining (*slodef* = n).
ORACLE:	VARCHAR(1)
NA Value:	- (a dash)
Range:	{d | n}

Name:	*snr*
Relation:	**apma, detection**
Description:	Signal-to-noise ratio. This is an estimate of the ratio of the amplitude of the signal to amplitude of the noise immediately preceding it. For **apma**, this is based on the maximum 3-component amplitudes (see *amps*). It is the average signal-to-noise ratio for the frequency bands that contributed to the final polarization estimates.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Range:	*snr* > 0.0

Name:	*snthrsh*
Relation:	**siteaux**
Description:	Nominal signal-to-noise ratio.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Range:	*snthrsh* > 1.0

Name: *splitev*
Relation: **ex_an**
Description: Indicates whether or not the analyst event solution contains arrivals which were previously associated with two or more expert system events.
ORACLE: VARCHAR(4)
NA Value: - (a dash)
Range: {y | n}, lower case

Name: *sproid*
Relation: **detection**
Description: Uniquely identifies a set of parameters used in the signal processing.
ORACLE: NUMBER(8)
NA Value: -1
Range: *sproid* > 0

Name: *srcref*
Relation: **knowlobj**
Description: Source-code reference (a brief reference code to a file or source body containing the knowledge object).
ORACLE: VARCHAR(64)
NA Value: - (a dash)

Name: *sta*
Relations: **ceppks, detection, fkdisc, fsdisc, mag_coefs, originamp, refarea, refevent, sbsnr, script, siteaux, smatchvar**
Description: Station code. This is the code name of a seismic observatory and identifies a geographic location recorded in the site table.
ORACLE: VARCHAR (6)
NA Value: In some tables, an entry in the valid range is required.
Range: Any upper case string up to 6 characters

Name: *staper*
Relation: **siteaux**
Description: Standard period at which noise estimates are made.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Seconds
Range: *staper* > 0.0

Name: *stav*
Relation: **detection, sbsnr**
Description: Short-term average used to describe the amplitude of a signal. The amplitude is averaged over a small time interval, typically 1-2 seconds. This time window is defined in Sigpro processing.
ORACLE: FLOAT(24)
NA Value: -1.0
Units: Nanometers
Range: *stav* > 0.0

Name: *stime*
Relations: **apma**
Description: Epoch time at which S-type polarization attributes are estimated. This is the center of the time window with the maximum 3-component amplitude.
ORACLE: FLOAT(53)
NA Value: -9999999999.999
Units: Seconds since midnight, January 1, 1970.

Name: *stmcor*
Relation: **siteaux**
Description: S-wave arrival time correction.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Seconds
Range: Any floating point value

Name: *sval1*
Relation: **smatchvar**
Description: Script value 1 for the attribute. This is equal to the mean value of the attribute (*amean* in **script**) if *sconf* is ≥ 0, otherwise it is the minimum value for the attribute (*amin* in **script**).
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Range: *sval1* > -999.0

Name: *sval2*
Relation: **smatchvar**
Description: Script value 2 for the attribute. This is equal to the standard deviation of the attribute (*astd* in **script**) if *sconf* is ≥ 0, otherwise it is the maximum value for the attribute (*amax* in **script**).
ORACLE: FLOAT(24)
NA Value: An entry in the valid range is required.
Range: *sval2* > -999.0

Name:	*svar*
Relation:	**spvar**
Description:	Variance of the de-trended log spectrum between *fmin* and *fmax*. The spectrum is measured in nm-sec.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Range:	Any floating point value

Name:	*time*
Relations:	**detection, fkdisc, fsdisc, siteaux, timestamp**
Description:	Epoch time, given as seconds since midnight, January 1, 1970, and stored in a double-precision floating number. *time* refers to the relation with which it is found, e.g., in **arrival** it is the arrival time, in **origin** it is the origin time, in **wfdisc** it is the start time of data, and in **siteaux** it is the start time for which measurements are valid. Where the date of historical events is known, *time* is set to the start time of that date. Where the date of contemporary arrival measurements is known but no time is given, then *time* is set to the NA value. The double-precision floating point number allows 15 decimal digits. At 1 millisecond accuracy this is a range of 3 $*10^4$ years. Where the date is unknown, or prior to February 10, 1653, *time* is set to the NA value.
ORACLE:	FLOAT(53)
NA Value:	-9999999999.999
Units:	Seconds

Name:	*timedef*
Relations:	**disassoc**
Description:	Time-defining code. This one-character flag indicates whether the time of a phase was used to constrain the event location. It is defining (*timedef* = d) or non-defining (*timedef* = n).
ORACLE:	VARCHAR(1)
NA Value:	- (a dash)
Range:	{n | d}

Name:	*tlen*
Relation:	**ampdescript, fkdisc, fsdisc**
Description:	Time window length. It should be NA in **ampdescript** if a velocity window is used.
ORACLE:	FLOAT(24)
NA Value:	-1.0
Units:	Seconds
Range:	*tlen* > 0.0

Name: *toameth*
Relation: **disorigin**
Description: The trial origin association method used by the expert system to form the failed event.
ORACLE: CHAR(12)
NA Value: - (a dash)
Range: {specials | locals | regionals | singles | doubles | triples}

Name: *toff*
Relations: **ampdescript**
Description: Offset from theoretical or observed arrival time. This attribute is used to define the start time of the amplitude measurement window and may be used in conjunction with either *tlen* to define a static window, or with *gvlo* to define a dynamic window. If *toff* is set to -999, then *gvhi* must be used to define the start time of the window.
ORACLE: FLOAT(24)
NA Value: -999.0
Units: Seconds
Range: *toff* ≥ 0.0

Name: *tsta*
Relation: **ev_summary**
Description: Number of teleseismic observations for an event. A teleseismic observation is currently defined as having a station-event distance ≥ 2000 km.
ORACLE: NUMBER(8)
NA Value: -1
Range: *tsta* ≥ 0

Name: *typwindow*
Relation: **refarea**
Description: Type of taper window applied to reference event waveform. Five types are available: "bartlett", "blackman", "cosine", "hamming", and "hanning".
ORACLE: VARCHAR(10)
NA Value: - (a dash)
Range: ["bartlett", "blackman", "cosine", "hamming", "hanning"]

Name: *validation*
Relation: **kaudit**
Description: Code to indicate the marking results from the validating application (e.g., PerfV). Markings are "va" for valid, "in" for invalid, and "ig" for ignored.
ORACLE: VARCHAR(2)
NA Value: - (a dash)
Range: {va | in | ig}

Name:	*validator*
Relation:	**validator**
Description:	Validator reference. This is currently the PerfV version that was used for audit trail analysis.
ORACLE:	VARCHAR(64)
NA Value:	- (a dash)

Name:	*validatorid*
Relation:	**kaudit, validator**
Description:	Validator identifier. This is the unique index for a particular validating application (e.g., PerfV).
ORACLE:	NUMBER(8)
NA Value:	- (a dash)
Range:	*validatorid* > 0

Name:	*value*
Relation:	**koconst, kovar**
Description:	Constant or variable string used in *knowlobj*.
ORACLE:	VARCHAR(16)
NA Value:	- (a dash)

Name:	*vdate*
Relation:	**kaudit**
Description:	The date the audit trail *validation* was marked.
ORACLE:	DATE
Range:	Valid date

Name:	*wfid*
Relation:	**detection, fsdisc, refevent**
Description:	Unique waveform identifier for a **wfdisc.**
ORACLE:	NUMBER(8)
NA Value:	-1
Range:	*wfid* > 0

Name:	*xcor*
Relation:	**refout**
Description:	Cross-correlation value between an event and a reference event.
ORACLE:	FLOAT(24)
NA Value:	An entry in the valid range is required.
Range:	$0 \leq xcor \leq 1$

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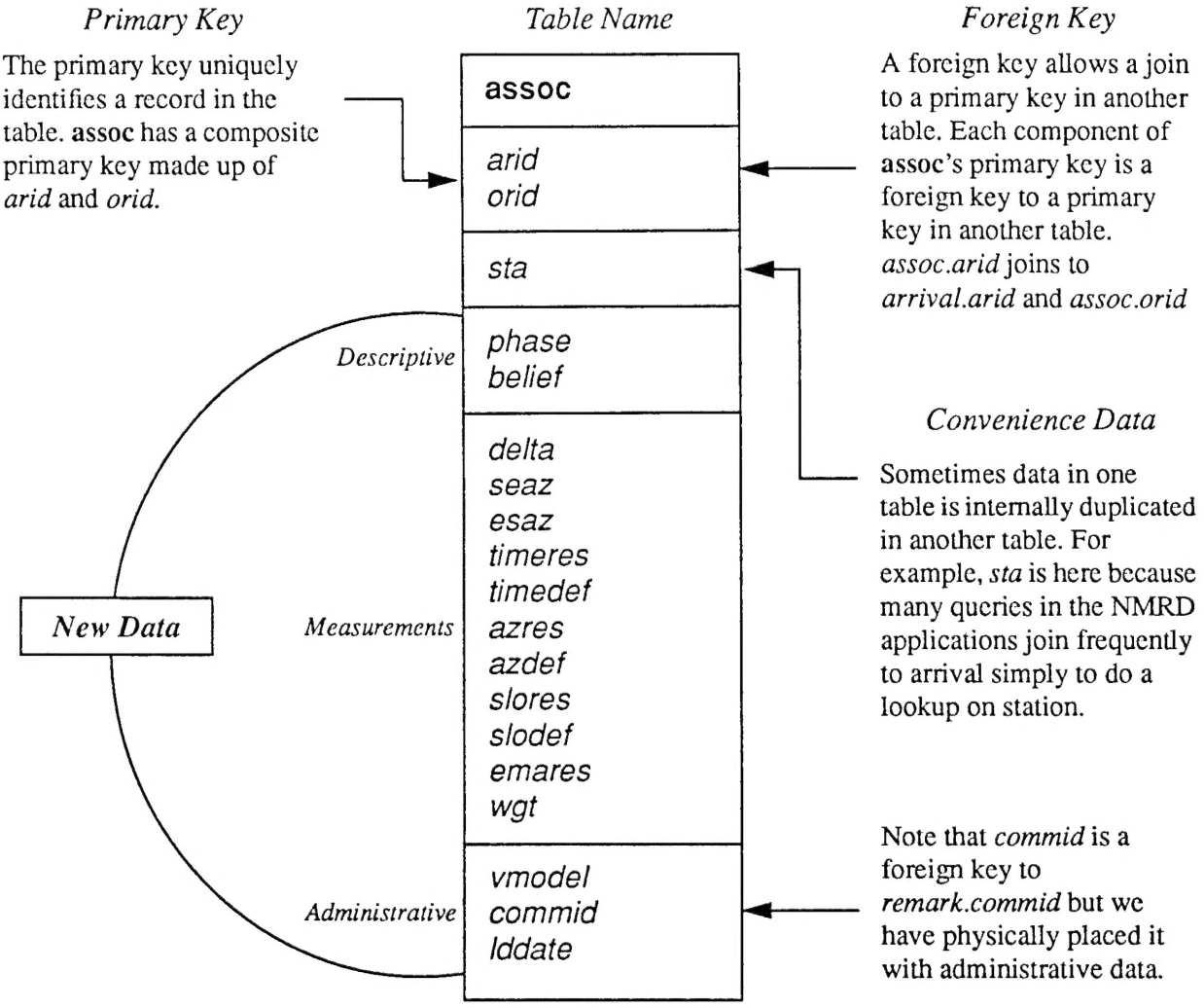
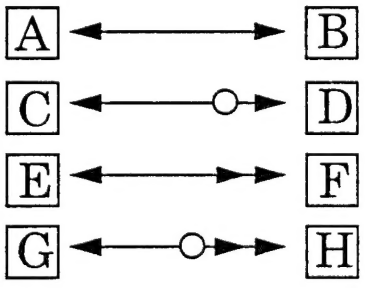
VI. Entity Relationship Diagrams

ANATOMY OF AN NMRD TABLE:



RELATIONSHIPS BETWEEN TABLES:



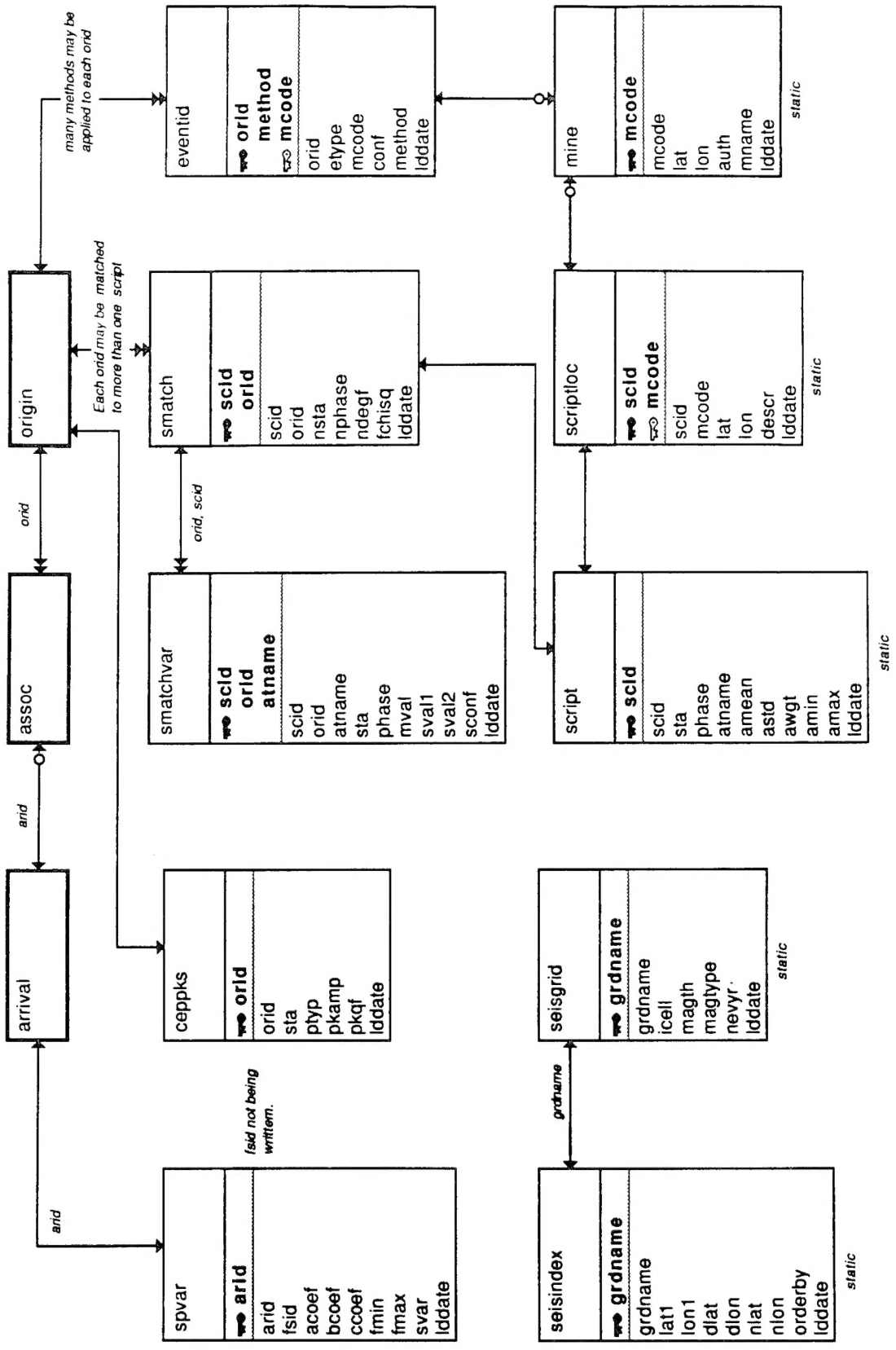
For one A, there is one B

For one C, there is zero or one D

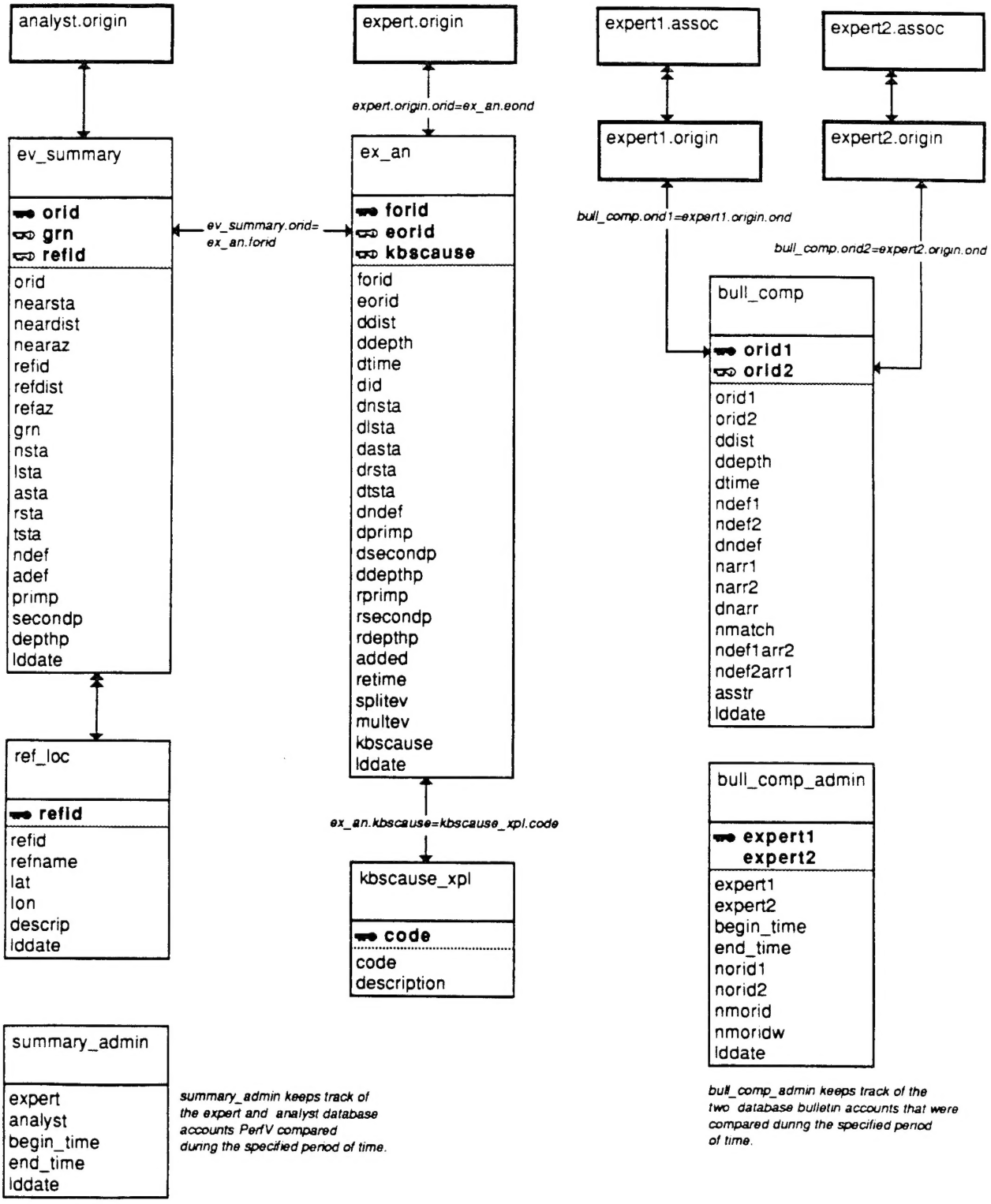
For one E, there is one or many Fs

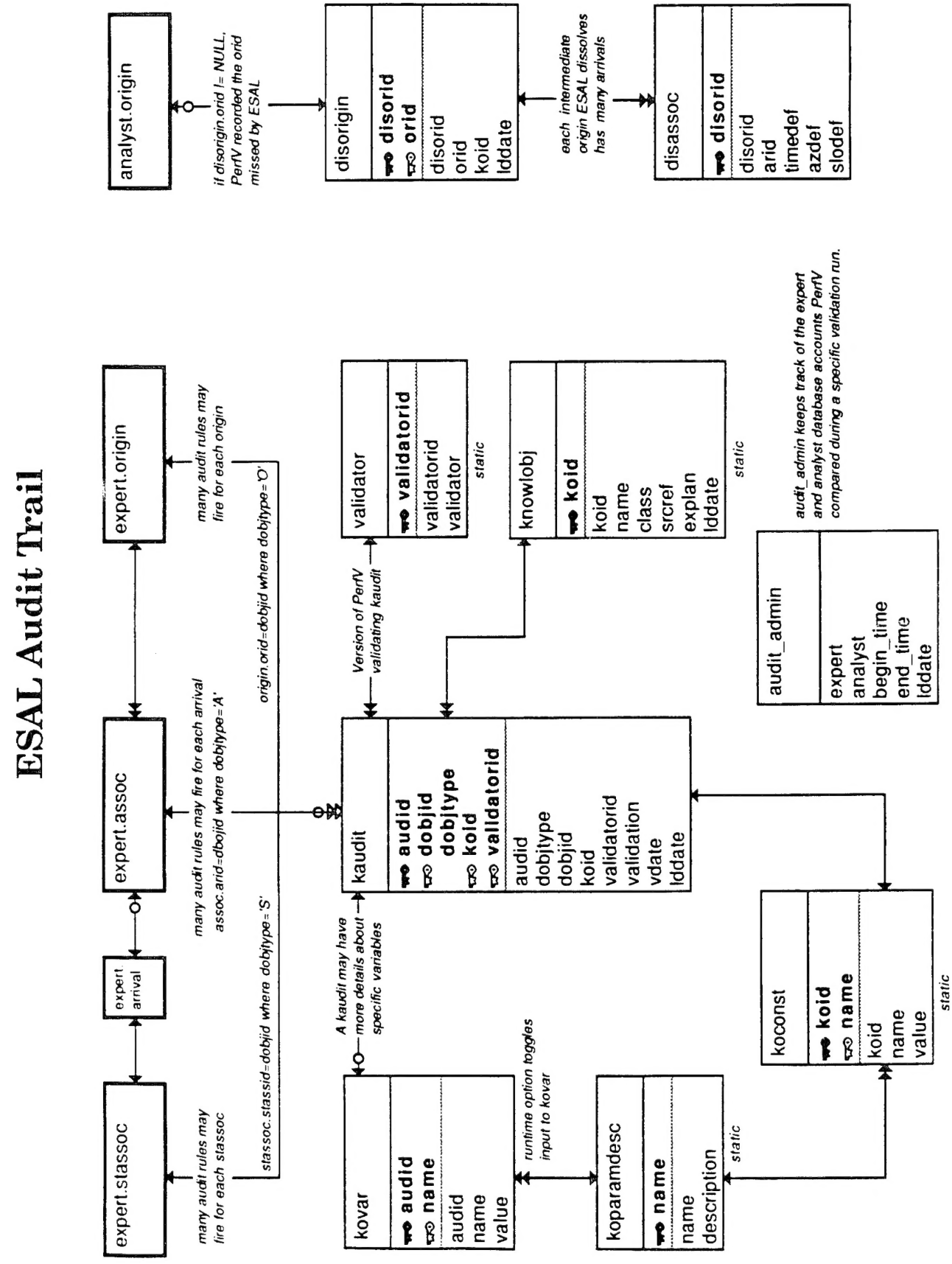
For one G, there is zero, one or many Hs

EventId


many methods may be applied to each orid
eventid
orid
method
mcode
orid
etype
mcode
conf
method
lddate
mine
mcode
mcode
lat
lon
auth
mname
lddate
static
origin
Each orid may be matched to more than one scrpt
smatch
scid
orid
scid
orid
nsta
nphase
ndegf
fchisq
lddate
scriptloc
scid
mcode
scid
mcode
lat
lon
descr
lddate
static
orid
assoc
orid, scid
smatchvar
scid
orid
atname
scid
orid
atname
sta
phase
mval
sval1
sval2
sconf
lddate
script
scid
scid
sta
phase
atname
amean
astd
awgt
amin
amax
lddate
static
arid
arrival
ceppks
orid
orid
sta
ptyp
pkamp
pkqf
lddate
fsid not being written.
seisgrid
grdname
grdname
icell
magth
magtype
nevyr
lddate
static
arid
spvar
arid
arid
fsid
acoef
bcoef
ccoef
fmin
fmax
svar
lddate
grdname
seisindex
grdname
grdname
lat1
lon1
dlat
dlon
nlat
nlon
orderby
lddate
static

PerfV


analyst.origin
expert.origin
expert1.assoc
expert2.assoc
expert.origin.orid=ex_an.eond
expert1.origin
expert2.origin
ev_summary
orid
grn
refid
orid
nearsta
neardist
nearaz
refid
refdist
refaz
grn
nsta
lsta
asta
rsta
tsta
ndef
adef
primp
secondp
depthp
lddate
ev_summary.orid=
ex_an.forid
ex_an
forid
eorid
kbscause
forid
eorid
ddist
ddepth
dtime
did
dnsta
dlsta
dasta
drsta
dtsta
dndef
dprimp
dsecondp
ddepthp
rprimp
rsecondp
rdepthp
added
retime
splitev
multev
kbscause
lddate
bull_comp.orid1=expert1.origin.orid
bull_comp.orid2=expert2.origin.orid
bull_comp
orid1
orid2
orid1
orid2
ddist
ddepth
dtime
ndef1
ndef2
dndef
narr1
narr2
dnarr
nmatch
ndef1arr2
ndef2arr1
asstr
lddate
ref_loc
refid
refid
refname
lat
lon
descrip
lddate
ex_an.kbscause=kbscause_xpl.code
kbscause_xpl
code
code
description
bull_comp_admin
expert1
expert2
expert1
expert2
begin_time
end_time
norid1
norid2
nmorid
nmoridw
lddate
summary_admin
expert
analyst
begin_time
end_time
lddate
summary_admin keeps track of the expert and analyst database accounts PerfV compared during the specified period of time.
bull_comp_admin keeps track of the two database bulletin accounts that were compared during the specified period of time.


ESAL Audit Trail
analyst.origin
if disorigin.orid != NULL, PerfV recorded the orid missed by ESAL
disorigin
disorid
orid
disorid
orid
koid
lddate
each intermediate origin ESAL dissolves has many arrivals
disassoc
disorid
disorid
arid
timedef
azdef
slodef
expert.origin
many audit rules may fire for each origin
expert.assoc
many audit rules may fire for each arrival
assoc.arid=dobjid where dobjtype='A'
origin.orid=dobjid where dobjtype='O'
expert.stassoc
many audit rules may fire for each stassoc
stassoc.stassid=dobjid where dobjtype='S'
expert arrival
validator
validatorid
validator
static
Version of PerfV validating kaudit
knowlobj
koid
koid
name
class
srcref
explan
lddate
static
kaudit
audid
dobjid
dobjtype
koid
validatorid
audid
dobjtype
dobjid
koid
validatorid
validation
vdate
lddate
audit_admin
audit_admin keeps track of the expert and analyst database accounts PerfV compared during a specific validation run.
expert
analyst
begin_time
end_time
lddate
A kaudit may have more details about specific variables
kovar
audid
name
audid
name
value
runtime option toggles input to kovar
koparamdesc
name
name
description
static
koconst
koid
name
koid
name
value
static